Making Money on Farm Crops

Floyd B. Nichols

MAKING MONEY ON FARM CROPS

Making Money on Farm Crops

BY
FLOYD B. NICHOLS
Agricultural Editor
THE FRUIT-GROWER AND FARMER

Published By
THE FRUIT-GROWER AND FARMER
St. Joseph, Missouri
1913

PREFACE

Increased efficiency is the keynote of modern farming. The effort toward the highest conservation is the goal of the best farmers, and it is a goal that is being approached closer every day. With a production from the farms of more than nine billion dollars in 1912, it is evident that agriculture is an industry that is large enough to command the energy and ambitions of any man. As in all other industries, the attention of the leaders is being given to reducing wastes.

The production of crops, the handling of the soils from which these crops grow, and the proper disposal of the feeds through the livestock route is perhaps the most important series of problems now before farmers. The key of the whole situation is to produce the maximum of yields with the minimum of expense, and this expense includes the important item of soil fertility.

There has been much progress in the last few years in more logical systems of cropping. In this time, there has been a great extension in the acreage of legumes, and a wonderful growth in the demand for lime and phosphorus. More farmers are using logical crop rotations than ever before. All these things are fine, and are encouraging items in the progress of American agriculture.

As the dark side to the picture, however, attention might be drawn to the poor results on many farms. There are too many cases of the farmers giving the rent on their farms and equipment, and the work of themselves and their families in exchange for a mere living, and sometimes a poor one. The fault, of course, is largely with the farm owners. Modern farms are business institutions, and an investment in one should pay interest on the capitalization, fair wages for the labor and leave a profit besides. Farms will do this, under present conditions, if they are handled properly.

What is most needed is for inefficient farmers to realize they are not using proper methods, and for them to study and adopt systems which the better producers have found to be the most profitable. Poor farmers are slow about doing this; slower, in

fact, than those in almost any other business. Professional men and merchants are ever ready to adopt new methods others have found to be successful. More than that, men in other lines hold many conventions, and pay experts high prices to address their meetings; for they realize the importance of progress. Farmers should take a lesson from this spirit of efficiency, which is paramount in the business and professional work.

In the period from 1880 until the close of the last century, much of the food grown in the United States was produced at a loss. This was made possible largely by the great extension of the cultivated area of the country, and the vast increase in the production of food. Great cities were built, and vast commercial enterprises were started which built up the cities, for there was cheap food for the workers. These cities now are firmly established as a part of American life, and the people are there who must be fed. The days of cheap land are past, and with them have passed the days of cheap food. The cost of living never will decrease, except as the cost of distribution is lowered, and it is logical to suppose that the producers also will profit from the elimination of middlemen. The high-cost-of-living specter, which is the constant companion of the peo-

ple of the cities, is the symbol of the opportunity of farming.

With increased prices for food have come high prices for land and equipment. While the opportunities in farming are much better than ever before, it is only the trained men and women, who understand how to use the mighty forces of the earth for the production of food and clothing, who will make a financial success. Efficiency is demanded on modern farms.

This book has been prepared to set forth the practical facts of logical crop management without all the mass of hazy, complicated technique which is often placed around them. The purpose has been to show how more money could be made from the soil. With increased profits from farming will come better homes, schools and churches. It is the hope of the author that this book will aid in obtaining these.

FLOYD B. NICHOLS.

CONTENTS

ILLUSTRATIONS

"BROTHER JONATHAN"
Trade Mark of The Fruit-Grower and Farmer
St. Joseph, Missouri

CHAPTER I.

SOILS FOR CROPS

CHAPTER I.

SOILS FOR CROPS

CHAPTER I.

SOILS FOR CROPS

A more efficient use of crop rotation and a larger acreage of legumes are badly needed in American farming. The soils of this country are not worn out, and all that is needed to increase the yields to a marked extent is more care in growing crops. If the one crop system of soil management used on so many farms were changed to a rotation adapted to the conditions, the average crop yields in the United States would not compare so disgracefully with those of Europe.

More Legumes Should Be Grown

The air is the cheapest source of nitrogen. This essential element for plant production can be obtained by the growth of legumes much cheaper than it can be purchased in the form of commercial fertilizers, under most conditions. Of course, there are a few conditions—truck farming on land near large cities is an example—where it would be cheaper to buy bone meal or some other fertilizer to supply nitrogen, but these are only minor exceptions.

The acreage of the leguminous—the nitrogen gathering—crops of the country could profitably be doubled. Too much energy and too large an acreage is taken up with growing crops like wheat and corn, until many fields have become so exhausted that they will not produce profitable returns in these crops. Much of this excessive cropping of the land with cereal crops has been brought about by tenant farming. But there is not the slightest excuse for a tenant not growing leguminous crops, if the landlord is fair with the contract. Legumes can be grown in almost all parts of the United

In the alfalfa fields of the West.

States, and their more liberal use would be of great importance and profit to both tenants and landlords. Cowpeas, for example, will grow in a very large section of the country. This is not a southern crop at all. There is no reason why tenants

should not grow this crop. In many cases it will return a greater profit than ordinary cereal crops, and its beneficial influence on soils is very great. Land owners should give tenants every encouragement to grow this crop.

What is a Good Rotation?

Under most conditions, a logical crop rotation will have a leguminous crop, such as alfalfa, clover or cowpeas; a crop for which the land must be well prepared, such as wheat, and a crop for which the land must be well cultivated, as corn and potatoes. Just the way these combinations will be made is ever the problem of the individual; for it is obvious that conditions such, for instance, as are found on

Diversified farming in Kansas.

the sandy soils of New Jersey and those of western Kansas require radically different rotation of crops.

Legumes are mentioned first in this general scheme because they should be given first place in planning a rotation. This is not only due to their beneficial effect on the soil, but also because they will produce returns that usually will exceed other field crops, if they are cut at the proper time, and the feed is well cared for and properly fed to farm animals. When you consider the rather high price of alfalfa hay in the last few years, you cannot beat the returns on this crop with wheat or corn, if the conditions are favorable for growing alfalfa. And if you will feed these crops properly, you can make greater returns than if you just sell the hay.

When Legumes Will Not Grow

In many sections there are fields that will not, under present conditions, grow legumes The soil is acid, and under these conditions alfalfa and red clover will not do well, and they usually soon will die, even if they start to grow. Make the litmus test for soil acidity, and be certain about the acid. This test is easy to make, and it is fairly accurate. This is the way to make it: Buy five cents' worth of blue litmus paper at a drug store, and take a ball of the soil you desire to test, and press the earth around the paper. If the ground is dry, add moisture. Let the ball stand for half an hour, then

break it open and look at the paper. If it has turned red, the soil is acid. Look at it carefully, for sometimes the change is faint. More than one test should be run, to guard against error. If the soil is acid, lime should be applied.

But lime has other beneficial influences besides the correction of soil acidity. For one thing, it decomposes potassium compounds, and thus aids in making potash more available. This does not mean that lime has any power to supply potash; it merely makes available the potash stored in the land. Lime also aids the phosphorous compounds. Soluble phosphorus combines with other compounds readily, iron for example, and forms a compound that is insoluble, and is rejected by plants. Lime, however, combines with phosphorus better than iron, and forms compounds that are soluble, and may be used by plants. Lime also will aid in the decomposition of organic matter. Now it is organic matter that furnishes the principal source of nitrogen and this supply must be reduced to furnish available nitrogen.

The flocculation of the soil, which is the forcing apart of the soil particles, is greatly aided by an application of lime. This is one of the most important effects of the application of this element.

One good test for the need of lime on land is the way red clover grows. If you can produce good yields of this crop, it is practically certain the

Soil-making agencies at work.

soil does not need lime. If the crops are poor and sickly, it is probable an application of lime would pay.

How Shall Lime Be Applied?

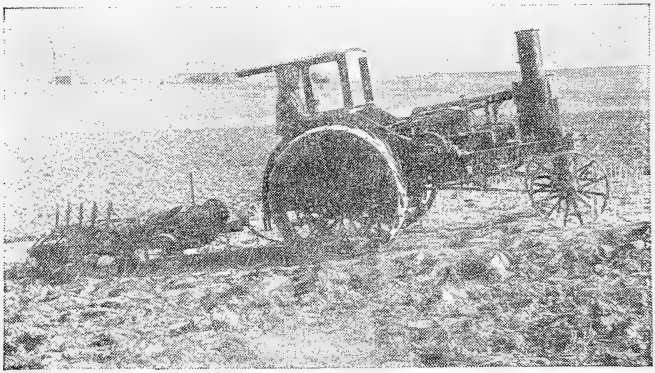
Ground limestone is the best form in which to apply lime, in most sections. Lime crushers that are small and cheap now may be purchased, and they are being introduced in many sections, to furnish ground limestone to the surrounding country. Larger plants—the one at the southern Illinois penitentiary is an example—have been built that are shipping many thousand tons of ground limestone a year. The increase in the sales of this material from the penitentiary plant is a good example of the extension in the use of limestone in other sections. The sales from this plant have been:

In 1906	122 tons
In 1907	1,520 tons
In 1908	2,428 tons
In 1909	4,846 tons
In 1910	14,135 tons

In addition, there are more than a dozen private companies furnishing ground limestone to Illinois farmers.

In speaking of the use of limestone on Illinois soils, Dr. Hopkins said: "The amount of limestone used in soil improvement in this state should rapidly increase until it reaches more than a hundred times the present demand, for the reason that lime-

stone is one of the necessary materials that must always be supplied for the highest improvement and permanent maintenance of Illinois soils, and also because at reasonable prices for limestone and



Farm tractors cheapen the cost of production. Deep plowing may be done at just the time it is needed.

farm produce, it can be used with sufficient profit to justify its application. Even the landowner who receives only one-half of the crops produced can afford to pay for the limestone when needed, and a share of the increased crops will likewise well pay the tenant for the hauling and spreading."

Small Limestone Crushers

In the judgment of the author, there will be a big extension of the use of small plants for crush-

ing limestone in the future. Small plants reduce freight charges; usually they eliminate railroad freights. In putting in a plant of this kind, always have a sample of the rock you expect to grind analyzed before you buy the machinery. Limestone varies greatly in composition, owing to the different percentages of foreign matter. Even two ledges in the same community might vary greatly, so be certain of the purity. Send a sample of the rock to the department of chemistry of your state agricultural college.

The most extensive experiments in this country on the use of different forms of lime on soils have been made at the Pennsylvania Experiment Station, and the results there were in favor of ground limestone. Quicklime tends to destroy the organic matter of the soil to a much greater extent than does ground limestone. So apply the ground material if the prices admit.

Classification of Lime Compounds

Ground Limestone.—The word lime, as ordinarily used, refers to burned lime or calcium oxide, but it is very often used to designate any form of lime without regard to its composition. Limestone in its natural state consists of lime or calcium oxide in combination with carbon dioxide, and is known

as carbonate of lime. It usually contains more or less of magnesium carbonate, together with some iron, aluminum and sand. It was originally supposed that magnesium limestone was injurious,

The out-cropping of a limerock ledge. Ground limestone may be cheaply produced here.

especially if used on the same soil for several years, but later researches have proved this belief is untrue, and that it is equally valuable with pure calcium limestone, for use on soils. Good limestone should contain at least 90 per cent calcium and magnesium carbonate.

The availability of ground limestone depends on its fineness. It should all pass through a sieve

of 80 meshes to the inch. Material coarser than this may remain in the soil for several seasons before becoming available. This form of lime may be applied to the soil in almost any quantity without danger, although it is generally recommended at the rate of 3,000 pounds an acre and sometimes more.

Burned Lime.—This is also known as "stone lime," "lump lime," "quicklime" and "caustic lime." It is produced from raw limerock by burning. One hundred pounds of limestone will produce 56 pounds of burned lime. This is the most active form of lime, and may be used at the rate of 1,000 to 1,200 pounds an acre. Much larger quantities are sometimes used, but the above amounts should be sufficient in most cases.

This form of lime is usually put upon the markets in lumps, and before being applied to the soil it must be reduced to powder. This is conveniently done by placing the lime in small piles about the field, and covering it with three or four inches of moist soil. The lime will absorb the moisture from the soil, and gradually break down into a fine powder, when it may be spread with a shovel. Ground burned lime may be purchased at a slightly advanced price.

Hydrated Lime.—When burned lime is treated with water or steam it enters into combination with the water and forms what is chemically termed calcium hydrate or hydrated lime. This form, like burned lime, is caustic, but it is always in the powder form, and may be readily applied to the soil. Fifty-six pounds of burned lime are equivalent to 74 pounds of hydrated lime. This form of lime is also known as slaked (slacked) lime.

Air-Slaked Lime—When burned lime is exposed to the action of the air for any considerable length of time, it gradually takes up moisture and carbon dioxide, and changes to the hydrate and carbonate forms. If exposed for a sufficiently long time, it will all change to the carbonate form or the state in which it was before burning. Its value lies somewhere between that of hydrated lime and ground limestone.

Equivalent Weights

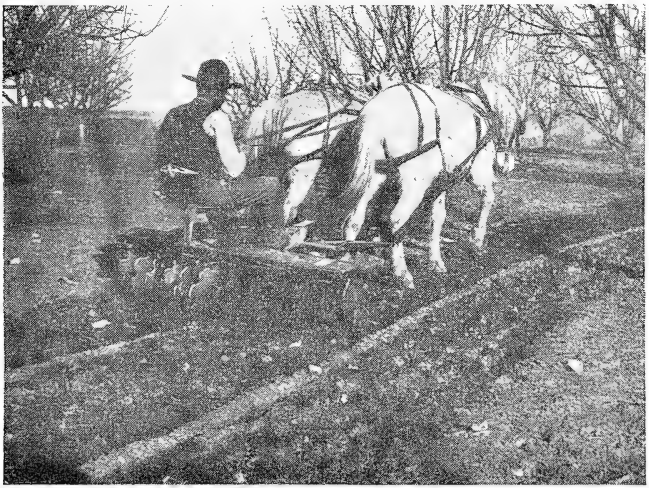
The different lime forms have different amounts of calcium present. When the compounds are free from mixtures, the equivalent weights are shown in the following table. Usually they are not quite

pure, but they generally are not very much adulterated.

1,000 pounds of burned lime is equivalent to:
1,351 pounds hydrated lime.
1,786 pounds ground limestone or marl.
1,351 to 1,786 pounds air-slaked lime.
About 3,000 pounds hardwood ashes.

Plants in Relation to Lime

After several years of careful experimenting upon the use of lime on various soils and with many crops, Dr. H. J. Wheeler, of the Rhode Island



Proper tillage is essential for the best results on all soils.

Experiment Station, has made a classification of plants according to their action with reference to lime.

The following table is based on Wheeler's classification:

Plants benefited by lime.	Plants indifferent to lime.	Plants injured by lime.
Beans	Corn	Watermelon
Beets	Millet	Blue Lupine
Celery	Golden Rye	Sheep Sorrel
Onions	Potatoes	
Cabbage	Carrots	
Pea	Red Top Grass	
Alfalfa		
Clover		
Barley		
Wheat		
Oats		
Timothy		
Kentucky Blue Grass		
Seed Fruits		
Stone Fruits		

The Use of Commercial Fertilizers

Frequently farmers are advised, usually by those interested in the sale of the material or by those who have not made a careful study of soil conditions, to apply a complete fertilizer, containing considerable amounts of the three elements apt to be exhausted in soils—nitrogen, potassium and phosphorus. A very common complete fertilizer is

one having a composition known as 2-8-2, which means it contains 2 per cent ammonia, 8 per cent phosphoric acid and 2 per cent potash. Fertilizer manufacturers usually state the percentages of fertilizing elements in this way. The amounts of actual fertilizing elements sound larger in these forms than when stated as nitrogen, phosphorus and potassium.

A ton of this material contains 33 pounds of nitrogen, 80 pounds of phosphorus and 33 pounds of potassium. Such a fertilizer usually is sold at retail for from $20 to $25 a ton, and sometimes higher. A 50-bushel crop of corn takes from an acre 75 pounds of nitrogen, 12 of phosphorus and 36 of potassium; and other grain crops have similar plant food requirements. Such a fertilizer would have to be applied at the rate of more than two tons an acre to supply the nitrogen, and at the rate of more than a ton to add the potassium. When the value of the yields of crops are considered, it may readily be seen that there is not much profit in such an investment.

Few soils are deficient in all plant food elements. If they are, they are very poor soils. Over every acre of land there is an inexhaustable supply of nitrogen that merely is waiting the growing of leguminous crops to become available for the use

of all crops. Use this supply. Nitrogen is the most expensive form of commercial fertilizer, and it can be obtained free if the proper crops are grown.

And then in regard to the potassium content of soils: There are not many soils in the United States where the potassium content needs any addition, or where such applications would pay. It is true, however, that there are such lands, but they usually are not deficient in both nitrogen and phosphorus, too. In most of the land in the north-central states, the soil contains, to the depth the land is plowed, 35,000 pounds of potassium, and deeper the soil contains similar amounts that will be brought to the surface, as it is needed, by the growth of deep-rooted crops, as alfalfa, and also by the gradual lowering of land levels. Muck soils frequently need potassium and phosphorus, but never nitrogen, so a complete fertilizer would not pay.

Add Phosphorus

There should be a great extension in the use of phosphorus on soils in the United States, and much of the extension in the use of commercial fertilizers in the future will be along this line. From the older soils of the East on through the fertile prairie lands of the Mississippi valley to the far

West, there are lands that would be improved markedly by applications of this material. The supply on many soils is low. If you believe this element should be added to your soils, buy a small quantity, apply it to the land, and note the result in crop yields that you get. Probably the best way to sum up the phosphorus proposition is to quote from a bulletin of the Indiana Experiment Station.

In a bulletin of this station on "Co-operative Fertilizer Tests on Clay and Loam Soils" these statements may be found: "Phosphoric acid and potash give a greater profit, for a dollar invested in fertilizer, than complete fertilizer, on both corn and wheat. In nearly all experiments with all crops on clay and loam soils, phosphoric acid was found to be the most effective of the fertilizing elements."

How to Find Out What the Soils Need

Never apply a complete commercial fertilizer unless you are certain the land is deficient in the three elements contained; and never use fertilizer of any kind until you are sure the soil needs it. Here is a good way to find out the fertilizer requirements of land: Lay out a number of experimental plats on a typical soil uniform in appearance throughout, each plat one rod wide and eight

rods long, that is, one-twentieth of an acre. Apply the different fertilizers carefully, and work them well into the soil.

8 RODS

1 rod	15 pounds Nitrate of Soda
1 rod	30 pounds Superphosphate
1 rod	15 pounds Sulphate of Potash
1 rod	15 pounds Nitrate of Soda 15 pounds Sulphate of Potash
1 rod	15 pounds Nitrate of Soda 30 pounds Superphosphate
1 rod	30 pounds Superphosphate 15 pounds Sulphate of Potash
1 rod	15 pounds Nitrate of Soda 30 pounds Superphosphate 15 pounds Sulphate of Potash

A few check plats, unfertilized, should also be laid out to allow proper comparison. All the plats must otherwise be treated exactly alike in the way of sowing and cultivation. Careful comparison of the crop results will reveal the plant-food requirements of the soil.

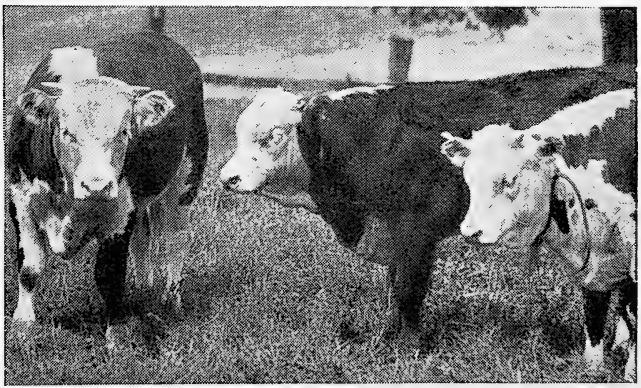
Apply the fertilizers broadcast, and harrow the land lengthwise, to avoid mixing the materials. The land for all these plats must be the same, in order to make the test of value. This test should be used where there is doubt as to just what the soil needs, and there is on most farms.

Where such tests have been made, it usually has been found that there is not a need for more than one or two of the elements, as a rule. You can take this as an axiom to follow in the application of commercial fertilizers: There are few fields where an application of a complete fertilizer will pay, and before commercial fertilizers of any kind are added, the soil types should be studied thoroughly, so you may know just what you are doing.

There is no disposition on the part of the author to discourage the intelligent use of commercial fertilizers. Not at all. On the contrary, it would be well if there was a great extension in their use. But there is a great deal of money

wasted every year by the addition of expensive elements that do not increase crop yields. A great many of the soils in the fertile corn sections of the West could profitably have phosphorus added to them, while the addition of the other two elements would not pay, in most cases. Study the plant food deficiencies of your soils, and know just what you are applying when you add fertilizers.

What is most disgraceful, however, is to see the vast sums that are being spent by farmers in grain sections for fertilizers that contain nitrogen.



Grow protein crops, and feed them to high-grade animals.

This, in most cases, is "bonehead" farming of the worst type. The Creator put the nitrogen in the air to be used, and there is no use in a farmer wast-

ing his profits on buying it when he can get all of this element he needs by growing legumes. Many times, farmers spend good money for commercial nitrogen and also for protein feeds, when both can be obtained by growing a leguminous crop.

In Regard to Green Manures

Green manure crops frequently can be used to good advantage, for the betterment of soil conditions. There is one thing that should be carefully considered, however, when one is growing these crops, and this is that when some crops, as cane, are plowed under, there is a great formation of acid, and if there is not a good supply of lime in the soil, the field may become acid. The continued growing of green manure crops, in some sections, has brought on just this condition. Of course, this can be overcome by the use of lime.

Cowpeas is one of the best green manure crops, and there is not so great a formation of acid as there is with many crops. When this fact is considered, and also that the crop adds an abundance of nitrogen to the land, it may be seen that it should be used for such purposes when possible. One of the principal objections to the use of this crop, usually, is the high cost of the seed.

Green manure crops frequently can be worked

in between other crops, without any loss of rent on the land, for it would not produce a crop anyway. Take, for example, the growing of a crop of cowpeas after wheat, where the field is not to be put into wheat again: The crop may be planted after the wheat has been cut, and in most sections it still will have time to mature a crop.

The increase in yield of wheat due to the cowpeas is generally given as from three to five bushels an acre. At the Missouri Experiment Station, an increase in yield of 63 per cent with oats and 49 per cent with wheat following cowpeas as a catch-crop was obtained. The Arkansas Experiment Station reports, as an average of four years' test with wheat, an increase in yield of 25 per cent from plowing under cowpea stubble in the fall, 39 per cent from plowing under cowpea vines, and 42 per cent when cowpeas were grown every year as a catch-crop between the wheat crops, only the stubble of the peas being plowed under.

At the Kansas Station cowpeas were sown as a catch-crop between wheat crops for five years, plowing under the entire growth of peas about the middle of September, two or three weeks before seeding to wheat. The cowpeas were sown every year soon after wheat harvest, in close drills, at the rate of about one bushel of peas an acre. The

field was usually double-disked ahead of the drill. Both plots were plowed on the same date and given similar preparation before seeding. The field used for this work was upland soil low in fertility. The yields for five years were:

YIELD AN ACRE OF WHEAT.

Treatment.	1904.	1905.	1906.	1907.	1908.	Av.
Wheat continuously	13.40	12.02	13.41	11.79	11.08	12.34
Wheat continuously, with cowpeas as catch crop	14.49	16.53	15.54	16.37	20.13	16.61

Every season the catch-crop of cowpeas gave an increased yield of wheat, and the effect was accumulative, the increase in yield being gradual from year to year. The first year of the trial there was a difference of only one bushel in favor of the cowpea rotation, while after five years the plot which received the green manuring produced nine bushels more wheat to the acre, the average difference being four and one-third bushels an acre in favor of planting cowpeas as a catch-crop between crops of wheat. Under average farm conditions it will not be possible to get cowpeas grown as a catch-crop between two wheat crops, because there is not time, but frequently it will be possible to plant it where wheat is not to be resown. This table shows the value of this use of cowpeas.

Drainage Helps

Fortunate indeed are farmers in the humid sections who do not have some land too wet for the best crop production. Wet spots are an aggravation to handle, for they delay the cultivation of the rest of the field. Then there are some fields where it will pay to underdrain the whole field. Before the perfection of tile drains, the handling of these fields often was a serious problem, and usually an elaborate system of ditches was constructed that took up a great deal of room. They were in the way and were inefficient. There is no excuse for that in this day of tile drains.

Usually the wet land that now is not producing good crops is the most fertile on the farm. In many cases, these wet spots have received the wash from the higher levels, and if the surplus water were removed the fields would produce crops far superior to average yields. Drain these swales, and give the crops a chance.

Drainage is Drought Protection

If your soil is tile drained, the crops will stand drought better than if it is not drained. While the reasons for this are plain enough, this fact is not well understood by the farmers of the country.

The reasons are that the physical condition of the land is improved by drainage, the land is more mellow and loose, air gets in the soil better, and

High quality poultry pays.

mainly the capillary water is more freely introduced, and is more available for the plant. It is the capillary water that is of importance in the development of the plant. Stagnant water is not, for the plants can not use it.

Drainage will deepen the soil, and allow it to warm more rapidly in the spring. It lengthens the growing season. It prevents soil washing, and makes a better home for the roots. And, most important, it allows the production of larger crops, as it will pay big in dollars and cents, and that is one of the main things we desire from land.

Use round tile drains. There are many companies making clay tiles, and usually farmers will find it is about as cheap, after the labor cost is considered, to buy these tiles as it is to make cement tiles on the farm, which is now being done in many localities. Cement tiles can be made that are of good quality and will produce good results, but the labor increases the cost of this type of drain so it is about the same as clay tile, under most conditions. When cement is low in price, the cement tiles may be materially cheaper than clay tiles.

The distance between the tiles and the depth will vary with the slope, amount of water to be removed, the nature of the soil, and just how quickly the water is to be removed. In many cases, all that is needed in draining wet spots in fields is the placing of a string of tile through the spot, and perhaps the use of a few short laterals. There are some fields where it will pay to put in an elabor-

ate system of mains and laterals, and cover the whole field.

One mistake many farmers make when they start into tile drainage is the use of tiles that are too small. No matter how well the tiles are laid, they may get out of line, and where one part sinks out of line, the part that is low will fill up with sediment, and thus the size of the drain will be reduced. Frequently a drain gets stopped up in just this way, and the whole drainage system is ruined. Never use tiles less than four inches in diameter, even for laterals.

What Can Be Expected From Drainage

As an example of the results one can expect from tile drainage, eight acres of land on the farm of Mont Van Buskirk, in Anderson county, Kansas, might be mentioned. This land was tile drained in 1911, and produced its first crop in 1912. The crop was corn, and the yield was 60 bushels an acre. The land never had produced a crop before. The first crop, valuing corn at 50 cents a bushel, paid for raising the corn, for laying the tile, and left a good profit besides.

The eight acres produced 480 bushels of corn, which is worth $240. The cost of the drainage system was $125, leaving $115 to pay for producing

the corn, and for profit. Then the value of the land has been increased to more than $100 an acre.

This drained land is a low swale typical of thousands of acres in eastern Kansas, and in many sec-

Wheat on drained land in Missouri.

tions elsewhere. A shallow ditch ran through the middle, and for several rods on each side water stood much of the year. The only growth was willows, some water grass and weeds. The field was too wet for pasture. The land never had produced anything.

This field was not a difficult engineering proposition at all. Through the middle of the wet land, near where the shallow ditch had been, a six-inch line of tile was placed. On either side, on slightly higher land, was placed a line of four-inch tiles. One of these smaller lines was 55 rods long, the other 14 rods. Two short, four-inch laterals were used, in addition. The fall was fairly good, so the

leveling was an easy proposition. This usually is the case, when draining low, wet swales.

The tiles were placed three feet deep. The cost of digging the ditches was 35 cents a rod. The work was done by contract, and this included the cost of laying the tiles, and filling the ditches after the tiles were laid.

The main ditch has an intake made of rock and gravel, which covers the tiles at the upper end, to care for the water that comes from farms above. The outlet is protected by rods and wire netting to keep out mice and other small animals that might enter when no water was flowing in the drain.

The system was constructed in the summer of 1911, too late to put in a crop. Most of the land was covered with willows, which caused some trouble when the land was plowed. The largest were grubbed. The compact roots of the willows forced the runners of the corn planter out of the ground some places, and this reduced the percentage of stand materially. The land was well cultivated, so most of the willows were killed, and they will not cause any trouble next year.

This land has received the wash from the surrounding hills, and the soil is very deep. In most

places, the soil was the same at the bottom of the tile ditches as it is at the top. This is typical of wet spots in that section.

The Land Drains Quickly

In speaking of the way the field dries, after a rain, Mr. Van Buskirk said: "The low, tile drained portion of the field can be cultivated sooner than higher portions where the tiling has not been placed. The reason is obvious. The drainage from the low land is almost perfect through the tiles, and it flows out rapidly. On the higher land, it must seep away by percolation through the soil, and drainage is slower."

Mr. Van Buskirk has used both clay and cement tiles. He has a machine for making cement tiles that cost $35, and in speaking of the operation of it, he said: "For cement tiles 12 inches long and six inches in diameter, the cost of the material was two cents each. This was for tiles made last winter, when cement was 20 cents a sack, which is very low. The cost of four-inch tiles was one cent each. We used one part of cement to four parts of sand. About 200 tiles of either kind can be made with this machine in a day. I do not think there is much to be saved by making cement tiles, over the cost of clay tiles, after the labor is consid-

ered. These prices I have quoted merely are the cost of the sand and cement. But when a farmer desires to do the work himself and to have some employment at odd times, it may pay him to make his tiles. I believe well-constructed cement tiles are the equal of clay tiles."

Cement tiles are good, if they are made properly, and they will last well. Whether it will pay to make them is merely a business proposition to be determined after the prices of the labor and material for the cement tiles, and the cost of the clay tiles is known.

Conserve the Barnyard Manure

A reform in handling the manure produced on farms is badly needed. Much of the fertilizing

In the Shenandoah Valley of Virginia.

value frequently is lost before it gets to the land. There is no reason for a great deal of elaborate detail in the way this material is handled. Get the manure to the soil just as soon as you can after it is produced, and use a spreader so it will be applied in the cheapest and best way. That is about all there is to it. Of course, you should remember that when manure heats and leaches, it loses about all its fertilizing value, and that more good can be obtained by spreading the manure thin, for a greater acreage will be benefited.

The Essentials in Soil Management

If you get some knowledge concerning the mighty forces that are making and changing the soils of the world, and how men can aid these forces, and then apply some good, hard common-sense to the proposition, you should be able to get good results from your land. The main essentials are these: Use a rotation that has a prominent leguminous crop, add essential elements, if the soil needs them, and then cultivate the land properly. The most important change that is needed is the introduction of good crop rotations—and do not forget the legumes.

CHAPTER II.

THE IMPROVEMENT OF FARM CROPS

CHAPTER II.

THE IMPROVEMENT OF FARM CROPS

Crop Breeding
Some Results in Plant Breeding
Select Seed Corn in the Field
Breeding Wheat for Profit
Opportunities in Seed Wheat Production
Breeding Alfalfa
In Regard to Treating Seed
Use a Fanning Mill

CHAPTER II.

THE IMPROVEMENT OF FARM CROPS

All cultivated crops have been improved from their wild, original state. Crops have been modified by the selection of suitable plants which approached the type desired. Farmers do not, as a rule, give so much attention to crop improvement as they should. There is too much crib selection of seed corn, and too much selection with a scoop-shovel for wheat and oats. That "like begets like" is one of the oldest of breeding laws, and one of the most fundamental.

Plants are the product of two forces, heredity and environment. Heredity is the characteristics the plant has inherited from past generations. Both are important, but heredity has an importance that is not always considered, which is that it acts without expense. It costs money and work to produce the best environment for the plants to live in; to plow, to disk, to cultivate, to hoe, all these take energy, and if the forces of heredity are not acting in a favorable way, the work may not be profitable. Scrub corn takes up the land just the same as that which has quality. You must do as

much work to cultivate it. And in the fall, it is found that the man who has used seed that has been developed by generations of intelligent selection is the one who makes the greatest profit on the season's work.

The breeding of farm crops along scientific lines is a comparatively recent thing. Before then, there had been selection that accomplished great good, and remarkable progress, but results have come much faster in recent years.

Crop Breeding

The principal things that delayed the breeding of farm crops after great progress had been made with farm animals was that the sex in plants was

Breeding plats, Kansas Experiment Station, where new races of wheat are produced.

not well understood, and there was a great difficulty in controlling the pollen. The control of pollen is one of the greatest problems of plant breed-

ers. With animals, the male may be tied up and thus kept confined, and while it is true the pollen of plants may be controlled, it is only at the price of great labor and patience. Plant breeders, however, have the advantage in that they can work with far greater numbers of individuals than breeders of animals.

In the improvement of plants, the first thing is to get the plant to produce variations. After this the problem is to select the forms that are the most desirable for the purpose the breeder has in view, and then to test these plants to see whether they will reproduce their kind. One of the hardest things is the selection of types to be kept.

The scientific principles that make up the science of plant breeding are so varied and complex that they have a literature of their own. Here, however, we are interested in what a farmer who does not wish to give the time to master all these principles can do to get money-making results. One does not have to follow Mendel's law through all the hazy science and near-science that has been hung upon it to get results in improving crops.

Some Results in Plant Breeding

The record of what some breeders of farm crops have done to get the results they have obtained is

of importance in showing what can be done in working with the types we have today. Take, for example, the history of the Leaming variety of corn. This variety was originated by J. S. Leaming of Hamilton County, Ohio, from scrub corn growing in that community. He decided what the ideal type should be, and he began a selection toward this type in 1826. He kept up the selection for 56 years, and his son continued the work. His method of selection was to go into the field as the earliest husks began to show signs of ripening, and select ears from stalks that tapered from butt to tassel; on which the ears were filled out well over the points, with straight rows of kernels, and which ripened in from 100 to 110 days. The Leaming corn has been somewhat modified by later breeders, but the general type still is the same.

Reid's Yellow Dent Corn was originated by James L. Reid, of Tazewell County, Ill. This type offers one of the best examples of corn that was selected in an intelligent manner, for it was graded up from a variety with small ears to the great variety that it is today. Robert Reid brought from Brown County, Ohio, to Illinois, in 1846, a variety known at that time as the Gorden Hopkins' corn. It was a small, reddish variety. There was a fair crop grown the first year, but the stand the second

year was poor. The missing hills were replanted with the seed of the Little Yellow corn, which was grown in that community. The seed has not been mixed since then, and the type in this variety is well fixed.

The Boone County White was originated by James Riley, Boone County, Indiana. He was

Patrons of husbandry.

growing a large, coarse type known as the White Mastodon, in 1876, and he began a selection at that time. The corn has not been mixed since then, and the results he has obtained have been by selection.

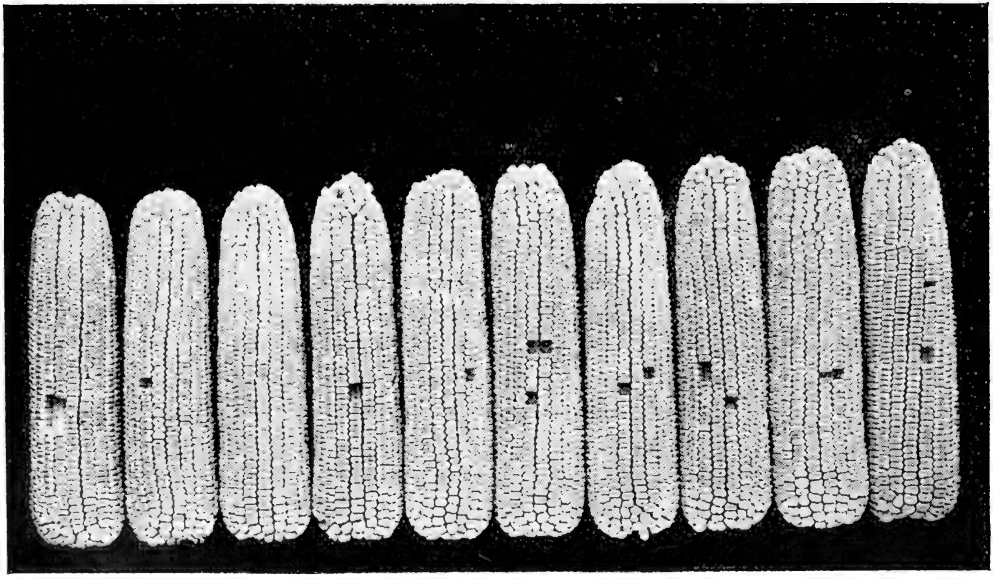
Some remarkable results were obtained at the Illinois Experiment Station in breeding corn to increase and decrease both the oil and protein con-

tent. Marked results were obtained. The experiment showed clearly that corn could be changed remarkably by intelligent selection toward some desired type.

In the breeding of corn, it is the selection of seed that farmers are mainly interested in. The main secret of intelligent selection of seed corn is to know what you wish to select. One of the principal troubles that is causing poor selection of corn is that farmers do not know good seed, and in many cases when they have a type fixed in their minds, it is a wrong type. After you determine on the corn you wish to grow, get a score card for this corn, and find out just how the best breeders are selecting their seed. Then, after you get this ideal firmly fixed in your mind, select your corn to conform to this standard as nearly as possible.

Select Seed Corn in the Field

Of course, field selection should be the rule. There is no excuse for crib selection, for there is very little work connected with field selection of the seed corn needed to plant the acreage on the average farm. In order to make an intelligent selection of an ear that will be used for seed the following year, it is necessary to know the stalk the ear grew on. Go into the fields some time before



A prize-winning sample.

shucking time, take a sack, and select the corn. Of course, you can do a good job of selection when you are shucking the corn, too, but the trouble is it takes more time, considering the time that you will spend glancing at the ears, than it does to select it earlier and have it done with, and it also makes it rather late, so it may not be possible to reduce the moisture content of the ears to a proper point for freezing weather.

The Department of Agriculture tested the comparative productiveness of ears selected from good yielding stalks in comparison with good ears of the same variety taken from a crib. The field-selected ears produced 16 bushels more an acre, or 20 per cent more than the crib-selected ears.

It is essential to care for seed properly, as this test shows. Four bushels of corn were harvested and divided into two equal parts. One part was well dried and kept dry during the winter in a seed house, and the other was kept in an ordinary corncrib. In the spring, the well-preserved seed was put in one box of a two-row corn planter and the cribbed seed in the other planter box. On rich bottom land planted in this manner the well-preserved seed produced 18 bushels more an acre, or 27 per cent more than the cribbed seed; while on poor upland the well-preserved seed produced

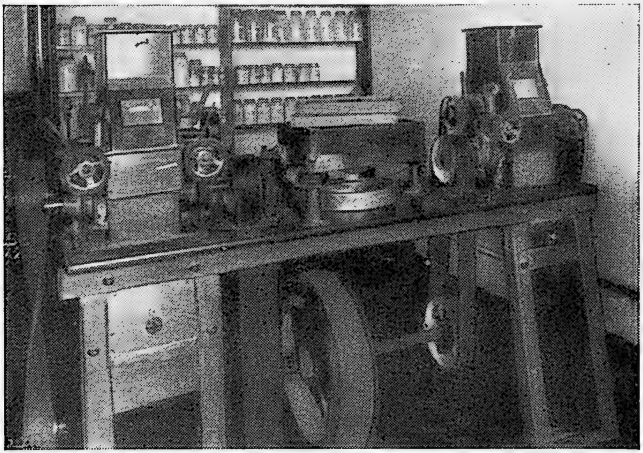
seven bushels more an acre, or 12 per cent more than the cribbed seed. The cribbed seed germinated as well as the well-preserved seed, but the resulting plants were less thrifty and less productive.

Breeding Wheat For Profit

The improvements that have been made in the wheats are an inspiration to plant breeders. Wheat originated in central Asia about the time man did, but the types that were known then were far different to the ones of today. The kernels were small, and the yields were not high. There are several divisions of economic wheats in addition to the bread wheats, such as macaroni, dwarf and poulard, but bread wheats are by far the most important. Wheat tends to readily adapt itself to changes in environment, and there have been many types developed. Most botanical writers believe that from 900 to 1,000 is a conservative estimate of the number of named varieties now growing in the world. Of course, many of these are similar.

The experiment stations have done some fine work in breeding wheats, to increase the yield and the milling qualities. Some splendid work has been done, and is being done by the Kansas Experiment Station, where several departments are working together to produce high quality varieties.

A department of milling industry has been established, and the milling value of the wheats are tested. It is no secret that there is a great varia-



The experimental mill used by the department of milling industry at the Kansas Agricultural College. Here the secrets of the bread values of wheats are discovered.

tion in the milling qualities of wheats grown in a given section, and under conditions that are similar. Millers cannot make the difference in price with these wheats that should be made.

One of the worst things is a mixing of types in wheat. If a wheat that is supposed to be hard contains a considerable mixture of soft wheat it does not have so high a milling value as if it were pure.

This would not be so bad if the percentage of mixture were constant, but it tends to vary in lots grown by different farmers. The millers often are accused of unjust discrimination against certain wheats, and of being over-particular, but it is no wonder, when one considers the mixed and poor lots of grain they get in the course of a year.

The wheats grown in the United States were originated both in this country and in Europe. The Fife wheat, for example, was originated by James Fife, of Ontario, Canada. Some seed wheat was obtained from a friend in Scotland in the spring, and not knowing whether it was a spring or a winter variety, he planted only part of the seed. The variety was a winter wheat, and but three heads ripened. These few grains were planted the next year, and they proved to be almost free from rust, in a season when most of the other wheat in that section rusted badly. The seed that resulted from the rust free plants then was carefully saved. This is the beginning of Fife wheat.

Opportunities in Seed Wheat Production

The hard types have perhaps been bred for purity with greater care than have soft wheats, and they are not so badly mixed. The soft wheat field that does not contain at least one or two per

cent of mixture is rare. There is an opportunity before the growers of soft wheat, which they should not neglect, to breed up some good, pure races of soft wheat. Under the conditions such as are found in the soft wheat sections of Missouri and Kansas, the hard wheat mixtures in soft wheat seem to stand the excessively hard winters much better than do the soft types, and this means their proportion tends to increase. This aids in increasing the demand for seed, and there is an opportunity to produce this seed at good prices.

The way to breed out undesirable types in wheat is this: Go into your fields next summer, after the wheat is headed and before it is cut, and cull out the foreign types you see. That is a fine time to do this work, or to inspect wheat for most purposes. You can tell at that time just what you have. You should remove the foreign types from enough of the field so you will have seed, but if this is too great a task, remove enough to start a good-sized seed-plat. Then, the next year, the foreign types can be eliminated from this plat, and if this is kept up, the mixtures should gradually disappear, and the wheat will become pure.

The methods that have been outlined for wheat and corn are well adapted to farm conditions. Of course, the professional plant breeder has the time

and opportunity to use methods that are more technical and exact, but there is no time on the average farm for the employing of elaborate head-row methods.

Breeding Alfalfa

Some fine results are being obtained in breeding alfalfa. The average stand of alfalfa contains many types, and the ones that are upright are the

It is essential that high-class animals be grown along with good crops, if the greatest returns are to be obtained.

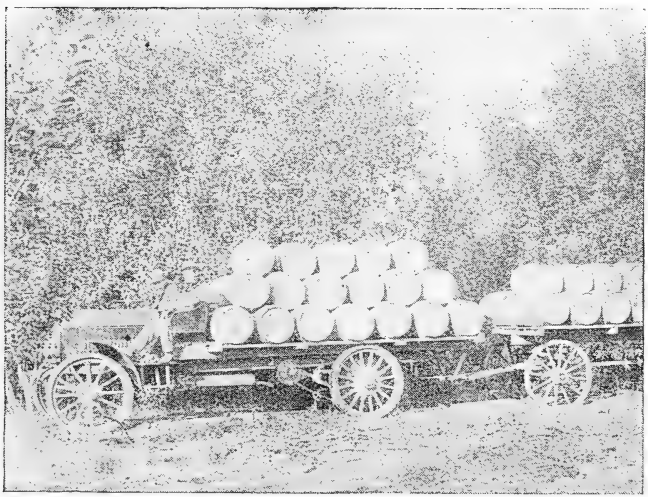
ones especially adapted for hay. The botanical department of the Kansas Agricultural College has been breeding these so they could obtain races in which all the plants had the upright habit of growth, and they are having good success.

On through all the field of plant life, it is evident what is needed mostly is the intelligent care in selection by average farmers. They are producing the crops of the country. If the experiment station men are the only ones who pay attention to producing high-quality grains, their work will not have the value it will have if farmers will care for this high quality seed after it is produced. More care and thought on the farms in the matter of seed selection is badly needed.

In Regard to Treating Seed

One of the best things you can do to increase the profits from crops is to eliminate smut damage. This is of great importance in the United States, for there are few sections that do not have some damage done by smuts in grain crops. All smut damage except that of corn can be controlled by treating the seed. The losses from smuts are of two kinds: (1) Those in the field where smutted plants take the place of sound plants and (2) those in marketing when noticeably smutted wheat receives a lower grade than smut-free wheat, and is often rejected. The field losses in the United States in 1911, as estimated by the Office of Grain Standardization, were as follows: From stinking smut of wheat, 1.7 per cent of the total wheat crop,

or 10,562,746 bushels, valued at $9,232,071; from smut of oats, 4 per cent, or 36,891,920 bushels, $16,586,520; from covered smut of barley, 1 per cent, or 1,602,400 bushels, $1,391,820; from loose smut of wheat, 0.85 per cent. or 5,281,373 bushels, $4,616,035; from loose smut of barley, 1.2 per cent, or 1,922,880 bushels, $1,670,184; a total field loss of $33,496,630. The loss to the individual producers who grow smutted crops is, of course, much greater than the average percentage for the United States.



Reducing expenses by cheapening the cost of hauling. There is a profitable field for the extension of the use of farm motor trucks.

In fact, in many of the fields in Pennsylvania, New Jersey, Wisconsin and Minnesota more than 10 per cent of the grain frequently is smutted. On the market, wheat affected with stinking smut to any considerable degree brings a lower price than smut-free wheat, because it can not be used for first-grade flour unless it is thoroughly washed and scoured. When the wheat is not too smutty, such cleaning can be done at nominal expense by mills which have the necessary cleaning machinery, but many mills in which such machinery is not installed reject all smutty wheat, and the producer gets a lower price for his product. This loss in 1911, as estimated from figures given in letters from state grain inspectors and representative millers, was equal to a reduction of one grade for at least 20 per cent of the total wheat crop of the United States, or one grade for 124,267,600 bushels. The price for every bushel is reduced on an average at least 2 cents for every reduction in grade. The loss from this source in 1911, therefore, would be $2,485,352. With this added to the field loss, a total loss of $35,981,982 was suffered by producers because of smuts in small grains during the year.

Use a Fanning Mill

Then comes the important item of eliminating scrub kernels, for they are present even in the best grain. This can be done by the use of a fanning mill, and this implement should be part of the equipment of every farm where grain is grown. In addition to the removal of the light and undesirable kernels, weed seeds also can be removed by this method. Discard scrub kernels just the same as you would scrub animals.

CHAPTER III.

PROFITABLE ALFALFA PRODUCTION

CHAPTER III.

PROFITABLE ALFALFA PRODUCTION

CHAPTER III.

PROFITABLE ALFALFA PRODUCTION

Alfalfa is, perhaps, the most important leguminous plant, considering the country as a whole. It is a crop that first was grown on a large commercial scale in the West, and it has been gradually spreading eastward. This is opposite to the way most cultivated crops have gone. From the valley of the Shenandoah northward to New York it is now rapidly becoming almost as important a crop as on the broader fields of the West. It increases the wave of prosperity wherever it is grown.

It is Easy to Get a Stand

Alfalfa is easy to grow on soils that are adapted to the plant. You should not have any trouble in getting a stand on good alfalfa land, if you plant good seed in a well-prepared seedbed. This is the condition of a good seedbed for alfalfa: The soil is loose about as deep as the seed is planted, and below that it should be firm and make a good connection with the subsoil. Be sure the capillary attraction with the subsoil is well restored after plowing. A loose seedbed will not do for alfalfa.

Alfalfa will succeed on many different soils ranging from sandy soils to heavier types. It will grow best on a deep, fertile loam well supplied with the mineral elements of plant food. The soil must be well drained, for on wet land where the ground water is near the surface, alfalfa will grow very poorly, and the plants soon die. And the crop wil not grow on soils that are deficient in lime, if there is a tendency for the soil to be acid. Alfalfa wil not live if there is an acid condition in the soil; anc this is the cause for much of the failure in getting a stand on the older soils in eastern Kansas, and in many other sections. The crop will do very well usually, on limestone soils. It does well on flinty soils formed by the decomposition of flint rock. Take, for example, in eastern Oklahoma, there are, in some sections, flint hills alternating with sand-

Jersey cows make a profitable addition to an alfalfa farm.

stone and limestone hills, and around the base of these hills the legumes, alfalfa, clover and cowpeas, all do better than they do on sandstone soils.

Some of the land in the corn belt is so worn that it is not in good physical condition to grow the crop, and it may be best to build the soil up by growing an annual leguminous crop such as cowpeas, before alfalfa is planted. In that case, you might put on the soil all the barnyard manure you can get, for it will have time to get into the soil before the alfalfa is seeded. Do not put manure on the soil the same year the crop is planted, for it will interfere with the capillary attraction, and not leave the soil in good condition for the crop.

Alfalfa Bacteria Must Be Present

Much of the failure in growing alfalfa is due to the lack of nitrogen-gathering bacteria in the soil. Bacteria grow on the roots of alfalfa, and gather the nitrogen from the air, which is stored on the roots in little nodules or swellings. Alfalfa will not make a good growth unless these bacteria are present. Nitrogen is an essential element for the growth of all plants, and on most soils it is the element most easily exhausted. And it is the most expensive element to purchase in the form of commercial fertilizers. The legumes are the only family of plants

that can use the nitrogen of the air, and they can not do so unless the bacteria are present and are working properly. All other plants must use merely the supply of nitrogen in the soil, and this usually is the limiting element in the yield of crops.

If the alfalfa bacteria are not present, you must supply them, of course. Now, there are many commercial cultures advertised that are successful if the conditions are all right, but if all of the conditions are not right, they will fail. So it is best to inoculate the land by the transfer of soil from an old alfalfa field. Transfer about 300 pounds of soil to the acre, and spread it over the field to be put in alfalfa, just before the seed is planted. Be very careful that the dirt does not dry out while it is being spread on the field, and harrow it in promptly, to mix it with the other soil. If the soil dries out too badly, the bacteria may die. And always use soil from an old alfalfa field to inoculate the new field if you can get it, for it is much more certain than artificial cultures. And this is important also: The bacteria that grow on the roots of sweet clover are the same as those that grow on the roots of alfalfa, and you can use soil from a sweet clover patch if you can not get alfalfa soil.

Under humid conditions, it usually will be best to sow alfalfa in the fall. Farther west, spring seed-

ing is sometimes to be preferred to fall seeding. If the seed is sown in the fall, some of the small grain crops usually will be grown for the preceding crop. In this case, the soil should be plowed early in July, about four inches deep. Harrow the ground after the plow, promptly, in order to break up the clods. Then disk the ground about every two weeks during the summer, until the seed is planted. Of course, if a drouth sets in and the surface becomes

A small flock of sheep can profitably be kept on most farms.

dry and loose, you need not disk the soil until a crust forms. These diskings will firm the soil and restore capillary attraction with the subsoil, con-

serve the moisture and aid in the formation of available plant food. All of this will put the soil in good condition, so the plants can make a good growth to stand the freezing of the winter.

No matter what methods you use, have these conditions when you plant the seed: Have the soil well pulverized about as deep as the seed is planted, and have it firm with a good capillary attraction with the subsoil below that.

Use Only Good Seed

There is some very poor alfalfa seed on the market every year. Much of it contains a large amount of weed seed, such as the seeds of dodder, plantain and dock, and with much of it the germination is low. In the buying of alfalfa seed, take this as an axiom to follow: Don't take anybody's word for anything. Always buy on sample, and know just what you are getting. Unless you are familiar with alfalfa seed you had better send a sample of the seed you expect to buy to the botanical department of your state agricultural college. The department will tell you the percentage of weed seeds present, just what these weeds are, and the per cent of the alfalfa seed that will grow. In that way, you can be certain of what you are getting. And you will, of course, have to pay a good price for seed. The

good grades of seed always are the cheapest. The colleges will cheerfully do this testing work free of charge.

If you desire to make a germination test of the seed yourself, and it is an interesting and important thing to do even if you have the seed tested by someone else, you can do it in this way: Take a cigar box or other small box, and place several folds of wet paper in the bottom. Place 100 seeds in this box that are a fair sample of the seed you desire to test. Cover the seeds with several folds of wet paper, and set the box in a warm place; almost anywhere will do in the summer months. Examine the seed in five days, count the seeds that have germinated, and throw them away. Remoisten the paper, and set the remainder of the seeds away for five days more. At the end of that time, count the germination results again, and stop the test. A large percentage of germination for the first five days indicates good, strong seed, while a slow germination indicates a weak seed that will not germinate in the field except under the most favorable conditions. The seed should germinate as high as 80 per cent.

Drill Alfalfa Seed if Possible

If you have planted the alfalfa on a well-prepared seedbed in favorable soil, you need not drill

in so very much seed. Heavy alfalfa seeding is not necessary. Twelve pounds of alfalfa sown on a well prepared seedbed will produce a good stand of the crop.

Always drill in the seed, if you can get a drill with a good grass-seed attachment. The drill will put the seed in the soil where the moisture will be available for the germination. Do not plant the seed too deep. Usually the seed should not be put in deeper than one inch, and on heavy soils the seed should be covered less than that. If the seed is planted too deeply, the young plants can not reach the surface, as the amount of plant food that is stored in an alfalfa seed is very small.

Care of the Alfalfa Stand

A very heavy stand of alfalfa is not so desirable as a medium stand. Ten or twelve stalks to the square foot is a thick enough stand, and it will produce better results than where the stand is thicker. It also is true that thin sown stands of alfalfa last better. Thickly sown stands tend to die rapidly.

Alfalfa should be cultivated, under most conditions. This is not so much to split the stems and thus increase the stand, as some farmers think, as it is to stir the ground, and aid in the conservation of moisture and the rendering available of plant food. Cultivation early in the spring also destroys

insects, and the eggs of insects that live on alfalfa, and this benefit usually is of great importance.

Do most of the cultivating by disking, early in the spring. The first year, do not use the disk, for the plants are not well enough established to stand its use. Generally it will pay, however, to run the peg-toothed harrow over the field. Do not cultivate with a disk until after the plants have become

A dependable farm team.

well established. Set the disks about as straight as possible, for if you do not, the crowns of the plants will be cut off. Generally it will be necessary to weight the disk.

Lime for Alfalfa

Alfalfa absolutely will not grow and produce profitable crops where the soil is sour, or where there is poor drainage. If you have either of these conditions in your fields, you should correct them before alfalfa is sown. Use tile drains to remedy wet conditions, and apply lime for the acid. Usually, the best form in which to apply the lime is ground limestone, for it generally is cheaper, and it does not have so destructive an effect on the humus as quicklime. Do not apply lime to the crop directly but apply it to the land some time before the crop is sown; a year before if ground limestone is used.

The amount of the application will vary with the amount of acid in the soil, of course, but, in general, two tons and sometimes more of ground limestone will be about right. Heavy applications are necessary where there is a great amount of acid.

When Should Alfalfa Be Cut?

Cut alfalfa when about one-tenth is in bloom. That means the crop should be cut when you can see blossoms here and there as you walk over the fields. This is an ideal stage for harvesting that is not used so much as it should be by alfalfa growers, especially for the first and second crops. These crops, especially in the corn belt, tend to interfere

with other farm operations, so the cutting of the crop is delayed. As a result, many growers are harvesting a crop of alfalfa straw instead of hay and the yield also is decreased, for if the first two crops are cut from a week to ten days, and sometimes longer, later than they should be, the number of cuttings will be one less than if all crops had been cut promptly. In Missouri, five cuttings can be ob-

By the careful use of modern machinery, alfalfa may be handled with a slight loss of leaves, and the labor can be reduced.

tained practically every year, if the cuttings are made at the proper time. But on many farms, this delay is the rule, and the number of cuttings then is reduced to four.

If it happens that you have hay that practically reached maturity before you cut it, feed it to horses, for, if there is any difference, mature alfalfa hay is not so apt to have injurious effects on horses. When frost has killed a partly matured crop, cut it at once, for the plants will start much better from the stubble than they will from the frosted tops.

Curing the Hay

After one has cut alfalfa at the proper stage, the most important thing then is to cure it so the leaves will not be lost. In common farm practice, quite a large percentage of the leaves are lost, which is about like losing an equal amount of good wheat bran, for the stems, on account of their high protein content, are about that valuable. The aim should be to expose the plants, after they have been cut, to the drying influences of the sun no longer than necessary. Do as much of the curing in the shock as is possible. The reason is this: If the stems are raked into windrows before the leaves are dry, they will continue to pump the moisture out of the stems, and the stems and leaves will cure out together. If the hay is left in the swath, exposed to the heat of the sun, the leaves are cooked, they become dry and brittle, and they fall off when the hay is raked. If your hay ever gets in this

condition, do not rake it until dew has fallen, and then the hay may be raked without losing so much of the leaves.

So this is the general plan to use: Rake the hay after the plants are well wilted, and do most of the curing in the windrow. After the hay is cured, haul it to the barns, and be careful in the handling to lose as few leaves as possible.

Store the Hay in Barns

There is not the slightest excuse, in this modern age with the high prices of hay, for stacking alfalfa. This high-priced hay does not turn water well, anyway, and if it is stacked, there always is a big loss to the hay, both in quality and quantity. A farmer can make more interest on money invested in hay sheds than he can in perhaps anything else on the farm, unless it is on money invested in machinery sheds.

Many types of hay barns are used, and all have their advantages. On stock farms, the type of stock barn that is commonly used in the West is good. Have the barn comparatively narrow, so there need not be much work done in distributing the hay after it has been dropped from the carrier. Twenty-eight feet is as wide as the barn should be and perhaps 24 feet is better. Have the barn as long as is needed

to hold the hay of the farm, and as high as economy of construction dictates. The sheds for stock should be on both sides, and have chutes arranged so hay may be thrown directly to the feed bunks, which should be in the shed. This will permit the animals to eat indoors, and thus be protected from the weather. That is important during the cold days of winter, for protection from exposure means that the animals will not need so much feed to keep them in good condition. Arranging the barn so the hay may be thrown directly into the feed bunks is of considerable importance, for it takes a great deal of extra labor to get the hay into wagons, and then pitch it into feed bunks.

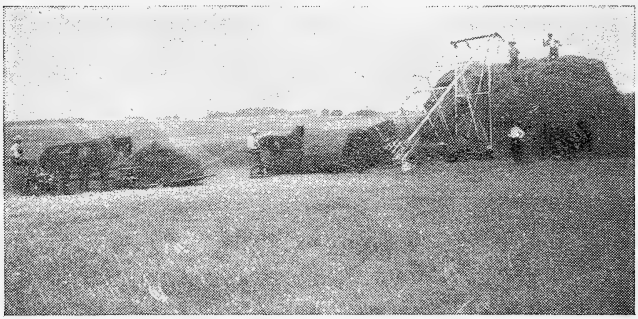
If You Stack Alfalfa

Keep the centers of the stacks high, if you do stack this crop. Alfalfa does not shed water well under any circumstances, and every effort must be made, in humid sections, to keep out the rain. Build large stacks, if the moisture content of the crop is down so it is safe. Of course, in the irrigated sections where there is little or no danger from rain, all these elaborate precautions are not necessary.

Always have stack covers that may be spread over the unfinished stacks at night, to guard against rain. In buying these covers, be sure you get them

Good farming and nice homes go together.

large enough, and you should get the ones that have been treated with chemicals to make them mildew proof. Cover the alfalfa stacks with coarse grass—the slough grass that grows in most sections



Stacking alfalfa in Nebraska.

is all right—to aid in shedding water. This coarse grass sheds water well, and as it does not have a high feeding value, anyway, it can be used with considerable profit on the tops of alfalfa stacks.

The high price of alfalfa in the last few years has encouraged many men to go into raising it for the market, and however reprehensible this practice may be, it is an industry of increasing importance. When this is the practice, the hay should be baled in the field, for there is a big loss of leaves if the crop is first put in the barn or stack, and then re-

handled in getting it into the bales. Use power, not only on account of greater economy in operation, but also because where the horses go around on the circle of the horse-power baler, the alfalfa

Loading alfalfa in Colorado. This is a sure way to exhaust any soil. Feed livestock and save the fertility.

will be killed, and there will be unsightly weed patches in the fields. Then, there is no use in knocking out teams on the baler, for they will be needed for other things later. Working on a baler is about the hardest work a team can do.

Sizes of Hay Presses

At the present time more than 70 makes of hay presses are on the market. As a result of the combined efforts of the hay associations and the manufacturers the sizes of presses have been standard-

ized within the past few years, making it easier for farmers to decide on the proper size to buy.

The sizes in general use now are as follows, according to the class of bales made:

Dimensions of small bales.....14x18x38 in., 16x18x36 in.
Dimensions of medium bales....17x22x36 in., 18x22x36 in.
Dimensions of large bales.....22x28x46 in.

The length of either size may be greater than the length here given. These sizes, with the exception of the 18 by 22 by 36-inch bale, are those in greatest demand in city markets, and in these markets they are known as standard bales. The various box presses make bales of a miscellaneous assortment of sizes, such as 42 by 18 by 20 inches, 44 by 24 by 22 inches, and 60 by 26 by 24 inches.

In respect to weight the standard bales vary as follows: Small bales from 70 to 100 pounds, medium from 100 to 150 pounds, and large from 150 to 250 pounds. This variation is due partly to the degree of compression and partly to the length of the bale.

Grades of Alfalfa

The usual grades of alfalfa on the principal market centers are:

Choice Alfalfa—Shall be reasonably fine leafy alfalfa of bright green color, properly cured, sound, sweet, and well baled.

No. 1 Alfalfa—Shall be coarse alfalfa of natural

color or reasonably fine leafy alfalfa of good color, and may contain 5 per cent of foreign grasses; must be well baled, sound, and sweet.

No. 2 Alfalfa—Shall include alfalfa somewhat bleached, but of fair color, reasonably leafy, not more than one-eighth foreign grasses, sound, and well baled.

No. 3 Alfalfa—Shall include bleached alfalfa or alfalfa mixed with not to exceed one-fourth foreign grasses, but when mixed must be of fair color, sound, and well baled.

No-Grade Alfalfa—Shall include all alfalfa not good enough for other grades, caked, musty, greasy, or thrashed.

Keep the Bales Off the Ground

In humid sections, where the bales are not hauled to the barn so soon as they are baled, they

Power balers are the most economical.

should be piled on sleds that raise the bales off the ground. Then cover the bales with canvas. If you do not do this, the parts of the bales that are on the ground will be spoiled, if rain falls. If the bales are piled off the ground, and covered, they will not be injured if it does rain, and they will cure better than if they were hauled to the barn at once.

As to the Moisture Content

There is more danger from moisture on alfalfa than from moisture in it, when it comes to having the hay heat. That means you should be especially careful with dew and rain, for it will have an especially damaging effect, after it is placed in the mow. When alfalfa is first cut, it will range high in water content; frequently as high as 75 or 80 per cent. When it is well wilted, and at the proper stage to rake, it will contain about 45 per cent. From then on, it loses moisture much slower, and the amount finally is reduced to from 18 to 22 per cent, when the hay is at the proper stage to put in the mow. After it is placed in the mow, the moisture content decreases slowly, and finally gets down to about 12 per cent. It rarely goes lower.

There is no absolutely certain way to determine the amount of hay in a mow by measuring it, but a fairly accurate way is to allow a seven and one-

half foot cube, or 422 cubic feet a ton, for hay that has been stored for several months. After the hay has been stored for a long time, and is about as well settled as it ever will be, a seven foot cube, or 343 cubic feet is about right. Any method, however, of measuring hay is only approximate, and the only accurate way is to weigh it.

Enemies of Alfalfa

Alfalfa is comparatively free from plant diseases. The few that do attack the plant do not have a wide distribution, as a rule. Red root-rot is a disease that has caused considerable damage in Europe, and in parts of the United States. Brown root-rot, which is somewhat similar to the red root-rot, has been reported in Texas, and has done some damage there. Rust and downy mildew sometimes bother one crop, but as a rule they do not trouble them all.

Gophers bother the fields in some places, and about the best way to get rid of this pest is to poison them. Grasshoppers trouble the alfalfa fields of the West, and the growers there use hopperdozers, which are shallow pans containing water and kerosene that are run over the land, just above the plants. The grasshoppers jump into the pans as

they are moved over the ground, in regular lands, and the insects are killed.

The clover hay worm is very fond of and devotes its entire attention to the various clover and alfalfa hays. The caterpillars usually appear toward the bottom of the stack in early spring, the hay which they infest having a moldy appearance due to the numerous fine silken threads they spin as they crawl about through it. It is badly cut up and rendered unfit for stock. This insect may be held in check by never stacking clover hay for two successive seasons in the same place, cleaning out the mow every spring so no old hay will be left over in the barn until the new comes, and never putting new alfalfa hay on top of old, either in stack or in mow. The worms in the hay can, if sufficient care and trouble be taken, be killed in the stack or mow by fumigation, but preventive measures are most satisfactory.

Alfalfa Seed Production

There is a good profit in growing alfalfa seed where a fair crop can be produced. According to the bulletin of the U. S. Department of Agriculture on growing alfalfa for seed, the factors of greatest importance are thickness of stand, soil moisture, and such climatic factors as rainfall and temperature. The local variation of one or more of these

factors accounts for the great fluctuations in seed yield often observed in a given season in a single locality and even on different parts of the same farm.

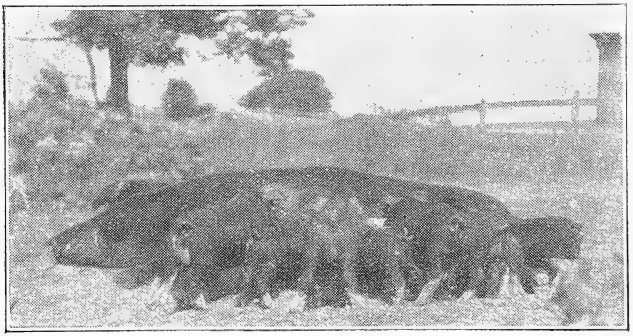
Experiments and observations have shown that thin stands of alfalfa tend to make good yields of seed much more certain. The reason for this lies largely in the fact that a thin stand permits a more complete development of individual plants. The greater amount of sunlight received by every plant in thin stands also tends to increase the production of seed. It is a matter of common observation that isolated plants along roadsides and in fence rows ordinarily produce much heavier crops of seed than do the plants in near-by fields.

The moisture content of the land is an important thing. It must be enough to enable the plant to mature its crop but not enough to cause the crown shoots to start while the seed is maturing. This margin between too much and too little water is a small one, and this is one of the principal causes of failure in producing seed.

Which Crop for Seed?

Usually the second or the third crop is left for seed, depending on the locality. August is a good time to have the plants maturing their seeds. The

setting of the seed should be watched carefully, for if there is to be a light and consequently unprofitable setting of seed, as is often the case, it is important that this be known as early as possible, so the crop may be cut at once for hay, and the succeeding hay crop allowed to begin its development. If the conditions before blooming are such as to produce a rank vegetative growth, it is a fairly sure



Luncheon.

indication that the chances are poor for seed. If, however, the soil becomes dry just at this time, a fair seed crop may sometimes be obtained. Also, if the blossoms appear sparingly or if they appear freely but blast or wither without setting pods, the chances for a seed crop are greatly reduced, and the crop should be cut at once for hay. After this

cutting, another fair crop of hay may usually be obtained. If the cutting be delayed too long, it will be at the expense of the next crop, as the time for its development may be short. Another indication that a seed crop is likely to be very light is shown when the basal shoots begin to grow in anticipation of the succeeding crop. The development of these basal shoots takes place at the expense of seed development on the older stems.

If heavy rains occur or if continued cold, damp, rainy weather conditions prevail when the plants are in full bloom, the prospects of a seed crop are greatly reduced.

The chances for seed are good if the reverse of the above conditions prevail, and the plants have made a medium stocky, well-branched growth with an abundance of bloom, especially if the warm, dry conditions continue. It is practically impossible, however, to infallibly foretell the seed crop. The crop is not assured until the plants are well loaded with clusters of well-filled pods.

When to Cut the Seed Crop

Cut alfalfa for seed when two-thirds of the pods have turned brown. The crop ripens in a very uneven manner, and if it is left much later than this, many of the heads will shatter, and much of the

seed will be lost. The heads that have turned only to a straw color at the time they are cut will make a fair quality of seed that will grow, although it will be somewhat lacking in plumpness. This table shows the result of cutting alfalfa at different stages of maturity.

Stage of maturity.	Percentage of seed found to be			
	Dead.	Alive.	Hard.*	Capable of sprouting promptly.
Pods green and not fully filled out	94	6	0	6
Pods green but full size	73	27	12	15
Pods just turning from green to a light-straw color; plump	17	83	58	25
Pods tured to a light brown; plump	11	89	69	20
Pods turned brown; fully matured.	9	91	68	23

*The so-called "hard seed" is perfectly good, but the seed coats are so hard that they are unable to take up moisture and sprout promptly. This condition disappears as the seed becomes older and is usually negligible in seed two or three years old. In sowing seed less than one year old, the proportion of seed that will not sprout promptly should be determined, and the necessary increase in the amount of seed to be sown should be provided for.

Threshing the Seed

Alfalfa may be cut for seed with either a self-rake reaper or a mowing machine equipped with a side-delivery buncher that will place the alfalfa out of the way, so the team and mower will not have to go over it on the next round. The use of one or

Build barns and store the hay. Alfalfa does not turn water well, and there always is a big loss if the hay is stacked.

the other of these tools is almost essential for the seed will be shattered badly, if it is handled like hay. Where the crop is not too heavy, it is possible to cut it with a grain binder, and this is the best way. In handling the alfalfa seed crop from the field to the stack, be careful that you do not shatter the heads. Use racks that have tight bottoms, to catch the seed that shatters out.

An alfalfa huller is the most satisfactory machine to use for hulling alfalfa seed. Where a huller is not available, an ordinary threshing machine can be used with fair results, if it is handled properly. It will be necessary to put up the concaves, and put in a special set of alfalfa sieves.

The straw obtained after the seed is threshed has about half the feeding value of the best alfalfa hay, but even this is considerable, and should be carefully saved. The bureau of chemistry of the U. S. Department of Agriculture has compiled the following table to show this value:

COMPOSITION OF ALFALFA STRAW AS COMPARED WITH THAT OF ORDINARY ALFALFA HAY.

Constituents.	Alfalfa.	
	Straw, Pct.	Hay, Pct.
Water	6.26	8.4
Ash	5.13	7.4
Protein	6.753	14.3
Crude fiber	47.82	25.0
Nitrogen-free extract	32.20	42.7
Ether extract (fat)	.84	2.2

The Feeding Value of Alfalfa

Alfalfa, where is will grow well, will produce a greater amount of digestible nutrients to the acre than any other crop. It is especially high in protein, and that makes it especially valuable for young animals. But on account of its high protein content, alfalfa is not a perfectly balanced ration or anywhere near it, and other feeds should be fed with it, in order to get the best results.

Alfalfa is one of the best feeds for cattle. It is of great importance in fattening cattle, and it also can be fed with great profit to young stock. When

On a dairy farm in Pennsylvania.

it is fed to cattle that are being roughed through, even small feeds have a very beneficial effect, and it is possible to feed large quantities of cheaper feeds and still have the animals go through the winter in good condition, if they receive even small quantities of alfalfa.

Its value as a feed for dairy cows is so well known that comment is not needed.

For hogs, the hay is too bulky to be used for fattening purposes on account of their limited digestive capacity. With brood sows, the case is different, and good alfalfa hay is rapidly becoming one of the important feeds for them in the winter. Sows that are fed alfalfa usually produce large litters of well formed pigs, in marked contrast to sows that have a ration composed too largely of corn. The value of alfalfa as a pasture for hogs is supreme. It is the best hog pasture crop, in sections where it will grow well.

Many farmers believe alfalfa is not a good feed for horses, and it is not when fed in large amounts to horses that are working hard in hot weather, although some farmers report good results even under these conditions. But there is no doubt that as a feed to make up part of the ration when horses are not working hard, alfalfa has considerable value, and should be fed, when it can be obtained.

Here is the average composition of alfalfa hay grown in Kansas, as given by the Kansas Experiment Station:

COMPOSITION OF ALFALFA HAY.

	First stage, about 10% in bloom.	Second stage, about one-half in bloom.	Third stage, full bloom.
Water	8.77	7.71	8.29
Ash	9.54	9.49	7.75
Crude protein	16.88	15.88	13.23
Pure protein	13.56	12.63	10.62
Crude fiber	29.38	31.44	33.11
Nitrogen-free extract	34.01	34.23	36.34
Crude fat	1.42	1.25	1.30

Of course, the composition of all feeds tends to change slightly in different localities.

Digestibility of Alfalfa

Well matured alfalfa hay is high in the amount of digestible matter. The digestibility of the hays referred to was ascertained, and the following table shows the results:

PERCENTAGES OF THE CONSTITUENTS OF ALFALFA HAY DIGESTED.

First crop; three stages of growth. Calculated to water-free basis.

	First stage.	Second stage.	Third stage.
Ash	6.69	5.78	5.16
Crude protein	14.51	12.89	11.37
Pure protein	11.94	9.90	8.57
Fiber	14.51	17.11	17.43
Nitrogen-free extract	28.52	26.96	30.72
Crude fat	.98	.42	.75
Total	65.21	63.16	65.43

"Here it is seen that the digestible protein diminishes markedly as the alfalfa matures, while the digestible carbohydrates increase. A calculation of the nutritive ratio in each case brings out this fact in a concise way. The nutritive ratio of a feed is the ration of the energy of the digestible nitrogenous substances to the energy of the digestible non-nitrogenous substances. Making the necessary calculations, the nutritive ratios are found to be as follows: First stage, 1 to 3.11; second stage, 1 to 3.49; third stage, 1 to 4.38. These are all narrow ratios, but they widen as the alfalfa matures.

"A full appreciation of the feeding value of alfalfa cannot be had without comparisons with other feeds. The average percentage of digestible constituents in well-known feeds is shown in the following table:

PERCENTAGES DIGESTIBLE OF FEEDS AND THEIR NUTRITIVE RATIO.

Feed	Protein	Carbohydrates	Fat	Nutritive Ratio
Corn	7.14	66.12	4.97	1:10.8
Oats	9.25	48.34	4.18	1: 6.2
Wheat	10.28	69.21	1.68	1: 7.1
Bran	12.01	41.23	2.87	1: 4.0
Shorts	12.22	49.98	3.83	1: 4.8
Timothy hay	2.89	43.72	1.43	1:16.2
Red clover	7.38	38.15	1.81	1: 5.7

"It will be seen that alfalfa cut at the first stage gave a hay that had a higher percentage of digesti-

ble protein than any of the feeds named in the table, and that the digestible carbohydrates—fiber plus nitrogen-free extract—of alfalfa compare favorably with those in the feeds cited, and in some cases exceed them. The nutritive ratios bring out clearly the value of alfalfa as a source of protein, and its great availability in balancing rations."

Loss By Weathering

It is apparent that alfalfa hay is greatly damaged by rain. This is due not only to fermentations that may accompany the process and to mechanical losses, but also to the fact that soluble substances are dissolved out and removed. Observations have been made by the Colorado Experiment Station upon a hay which was exposed in the field for fifteen days, during which time it was subjected to three rains, amounting to 1.76 inches. The following table shows the composition of the damaged and of the undamaged hay:

PERCENTAGE COMPOSITION OF ALFALFA BEFOR AND AFTER DAMAGE BY RAIN.

	Ash	Protein	Fiber	Nitrogen-free Extract	Fat
Original	12.2	18.7	26.5	38.7	3.9
Damaged	12.7	11.0	38.8	33.6	3.8

The History of Alfalfa

Man has cultivated alfalfa for many centuries. It originally was cultivated in the countries around the Mediterranean Sea, and the evidence indicates the people there obtained it from central Asia. It was introduced into the United States by the Spanish settlers, and was grown in the Western States first. It gradually has spread to the Eastern States. The first car of alfalfa received on the Kansas City market arrived in 1892. Alfalfa hay was not graded on that market until 1898.

The Value of Alfalfa

The importance of alfalfa is now well understood by most farmers, and the acreage is increasing rapidly. There will be a much greater extension of the acreage in the future. The acreage in the United States could be doubled with considerable profit.

CHAPTER IV.

HOW TO GROW CLOVER

CHAPTER IV.

HOW TO GROW CLOVER

Soils for Clover
Clover in the Rotation
Sowing Clover Seed
Medium Red Clover
Getting the Stand
Yellow Trefoil in Red Clover Seed
When to Cut Medium Red Clover
Storing the Hay
How to Make a Pole Stacker
When Clover Hay is Placed in the Mow
Red Clover for Ensilage
To Destroy Clover Insects
Cutting for Seed
Utilization of Clover Straw
Enemies of Red Clover
The Clover Root-Borer
Red Clover for Pasture
Bloating of Animals on Clover
Red Clover as a Feed
Clover for Seed
To Destroy Clover Insects
Cutting for Seed
The Clover Root-Borer
Fungous Diseases of Red Clover
How About Mammoth Clover?
White Clover for Pasture

CHAPTER IV.

HOW TO GROW CLOVER

Clovers are adapted to a great variety of conditions, and they are very extensively grown in this country. Their acreage is especially large in the North-Central states, where alfalfa has not taken the field, as yet. The Mammoth Red and Medium Red varieties, which are the most important, considering the country as a whole, can be grown the best between parallels 37 and 49 north latitude. Alsike clover has a range of adaptation that is somewhat similar to that of the Mammoth and Medium red varieties, but it also may be grown farther north, and in localities where the soil is wet. Alsike is especially adapted to wet conditions, and should be grown there, but where the land is adapted to the growth of the other two crops, they usually will produce greater returns. Crimson clover grows well in the states east of the Allegheny mountains, and in the South. White clover will grow almost anywhere there is a sufficient amount of moisture.

Soils for Clover

Red clover grows best on clay-loam soils, but it has a range of adaptation, and is found growing

Running the separator.

well on soils that range from rather sandy types to very heavy and compact soils. In southeastern Kan-

sas, where the soil types may change from poor blackjack hill ground that has been formed mostly by the decay of sandstone to heavy hardpan lands in a few hundred yards, clover may be found growing successfully on both types. In this connection, it might be said that the adaptation of clover for sandy lands varies markedly with the subsoil. If the sand is underlaid with a clay subsoil at a depth of not more than 18 inches, the crop will do much better than if the subsoil is sand.

Clovers are gross feeders on potash and lime, and the sandy soils often are deficient in these elements. However, by fertilization methods such as those that have been worked out on the poor soils of the Atlantic coast states, this crop may be grown even on almost the poorest of these lands. Clover is not adapted to growing on muck soils, for such land usually is deficient in mineral elements clover needs in abundance.

Clover in the Rotation

Clover is especially adapted as a rotation crop, for it will add much nitrogen to the land in a comparatively short time, and in that respect it is ahead of alfalfa, which is not so well adapted to a short rotation. Its place in the rotation will depend largely on the other crops grown, of course, but

under cornbelt conditions, the best crop to follow it is corn. Clover adds much nitrogen and humus to the soil. It also tends to lessen weed growth, and all these factors make it especially adapted to growing before corn. If the crop is grown before wheat, there may be such a large amount of soluble nitrogen in the land that the wheat will lodge, and most of it thus be lost.

The rotation of corn, oats, wheat and clover is common in the cornbelt, and it is good. In this rotation, some of the best money-making crops are grown, and they all make a logical rotation. Clover should be grown with wheat as a nurse crop, if the land is fairly fertile. It is especially adapted to spending its first few months under another crop. Wheat is an especially good nurse crop. The leaves tend to ripen slowly, and let the light and heat in to the clover gradually, and thus when the wheat is cut, the sun is not so hard on the plants as it would have been with some other crops; oats, for example.

The seed may be sown on the last snow, or it may be sown about April 1, and harrowed in. The latter usually will be found to be the best way. If the seed is sown on the last snow, some of the plants will be killed, if there is a warm period in which they are started and this is followed by se-

vere cold weather. This frequently happens, and many stands of clover have been lost in this way. If you wait until later in the spring, after the danger of severe frosts has passed, and then plant the seed, the plants will not be killed. If the land is harrowed properly, the seed will be placed where it will germinate readily, and the harrowing frequently will be a positive benefit to the wheat. There usually is a crust formed on the land that should be broken in the spring, if the plants are to make the best growth.

Sowing Clover Seed

There are a few farmers who can do a good job of sowing clover seed by hand, but the proportion is small. Not many of the younger farmers have learned this art well enough so they can do the work well, and the cost of the education of the average man for this work is great, considering the number of poor stands he must sow until he gets experience. It always is best to use a seeder, and there are many seeders on the market that are good. When the seed is to be sown on land that is not in a nurse crop, use a drill with a grass-seed attachment. The seed can be placed at a proper depth much better than when it is sown broadcast.

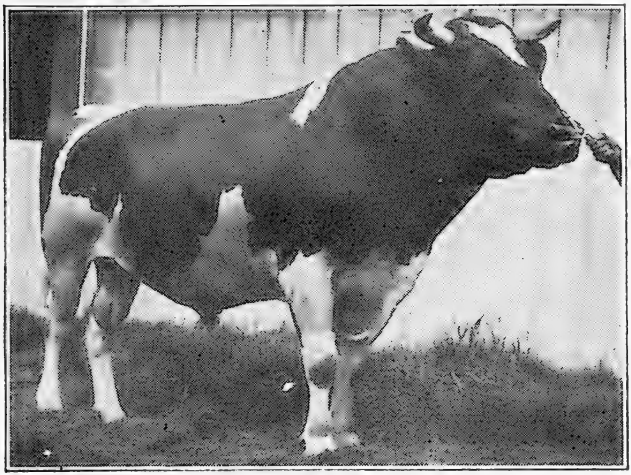
Medium Red Clover

Medium red clover also is known by such common names as common red and broadleafed clover. In many cases it is called red clover, and the larger variety mammoth, to distinguish it. It has a spreading-upright habit of growth. Every plant contains several heads, usually many, and a clover field in bloom is a most beautiful sight. Pigs in the clover is one of the principal themes of farm poets.

In most of the corn states, this crop is a biennial, but on the Pacific Coast it is a perennial. Even in the corn states, however, some of the plants seem to be perennial. And this condition also causes many of the fields in that section to last for more than two years: Wheat cutting, corn plowing and clover cutting come at the same time, in the latter part of June and the first part of July, and clover usually is the crop that must wait. Frequently, some of the seed gets ripe and shatters off when it is raked. Thus the plants tend to reseed the field.

Red clover furnishes an excellent grade of hay, and is valuable for pasture, especially in the spring and fall. Most stock raisers pasture the crops early in the spring and in the fall, and they get some valuable feed at a time it is needed badly. Pasturing clover in the spring is a positive advantage where there is trouble in getting it cut at the proper

time. The pasturing will delay the maturing for some time, until the rush of the harvest is past. And then, on very rich soils, it will tend to prevent the crop falling down. That is one of the disrepu-



A Holstein champion.

table things clover sometimes will do, where the soil is rich. If timothy is sown with the crop, it will tend to prevent this to a considerable extent, but pasturing also will aid materially.

Getting the Stand

One of the principal sources of failure in growing clover is poor seed. Good seed is plump and

bright, with the color ranging from violet to light brown. New seed usually has a hard seed-coat, and it may not be so desirable to sow as older seed. This seed-coat in clover and alfalfa is a deceptive thing. Usually the stand will be increased after the first lot of plants has come up. Many of the seeds, especially if they are not old, have a hard seed-coat, and it takes some time for the moisture to bring about germination.

Poor clover seed may be shriveled, and if it is, the germination usually is weak. Such seed generally is dull-brown in color. Frequently the seed is adulterated or contains bad weeds that should prohibit its use as seed. The introduction of plantain, yellow trefoil and the like in red clover seed is too common, for a large percentage of such seed on the market contains these weed seeds. The only way to be sure the seed is all right is to have it tested. The botanical department of your state experiment station will do this work free, and you should send a sample to it. Buy clover seed only on sample, and have the sample tested before you accept the lot. The department will tell you the percentage of seeds that will grow, and the weed seeds that are contained. If you merely wish to make a germination test, you can do it yourself. It is an interesting thing to do, even if the seed is tested at

the experiment station. Here is the method recommended by the U. S. Department of Agriculture:

From the red clover seed, separated from all impurities, a counted number, as 100, should be taken just as they come. These seeds should be placed between layers of moistened cloth or paper or merely covered in a bed of sand or light soil. The germinating receptacle should be held at the temperature of a living room, varying between sixty-five and eighty-five degrees Fahrenheit. Between the third and sixth days, the sprouting ability of the seeds should be shown. Seeds which at the close of a week are still hard, not yielding to the pressure of a knife blade, are "hard" seeds, and are to be considered little better than dead seeds for sowing. It should be borne in mind that the sowing value of the seed is represented by the amount of true clover which will germinate with reasonable promptness. Thus, if four-fifths of a sample is pure clover and but three-fourths of this clover will sprout, then only three-fifths or sixty per cent of the original seed as offered will grow. The examination of the seed is facilitated by the use of a magnifier; one is easily obtainable for about fifty cents.

Yellow Trefoil in Red Clover Seed

Red clover seed is adulterated with imported yellow trefoil, which resembles clover seed closely, and may easily escape detection. A small quantity of trefoil may appear incidentally in the clover seed. In cases of adulteration, thirty to forty per cent, or even fifty per cent, of the bulk may consist of trefoil.

The mixing of trefoil seed with better seed has practically all been done in this country. The development of public interest in the matter of seed impurities made within recent years, together with the publication of the names of dealers found to be handling adulterated seed, has resulted in a marked reduction in the importations of trefoil seed. A corresponding decrease in the quantity of red clover seed adulterated with trefoil has been observed. Tests of red clover seed made at the seed laboratory of the U. S. Department of Agriculture show that trefoil is used as an adulterant in variable quantities, sometimes exceeding fifty per cent. In the majority of cases it has amounted to more than twenty per cent. The close similarity between trefoil seed and red clover seed renders detection of the trefoil by the average purchaser improbable unless sought especially with the aid of a magnifier.

If all seed was bought on sample, and the samples tested, this little graft would be eliminated.

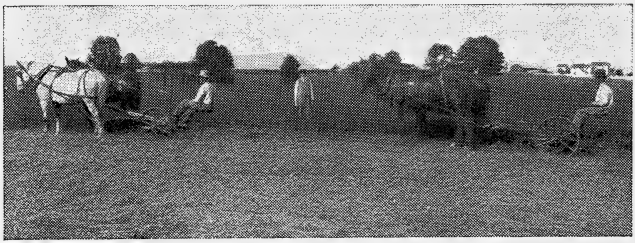
Inoculation for Red Clover

Clover must be supplied with the nitrogen gathering bacteria that store the nitrogen of the air on its roots. If these bacteria are not present, there will be no nitrogen stored, and the clover will not do well. Inoculation for clover may be brought about by the use of pure cultures of the bacteria. This method, however, is rather uncertain, and even a trained specialist has a high percentage of failures. It also is possible to apply the bacteria by spreading the leaves and stems, but the value of this method is not equal to that of spreading soil, from a field that is growing clover well, on the field it is desired to inoculate. Add 300 pounds of dirt from a field where the clover is thrifty and has large tubercles on the roots. Be certain the soil does not dry out while it is being transferred, as this will injure the bacteria. Harrow the field when the dirt is applied, so it will be mixed with the soil in good shape.

When to Cut Medium Red Clover

Cut the clover for hay just after the stems have passed full bloom. At this stage, there is a maxi-

mum amount of protein and dry matter present, the leaves are still intact, and the stems are green. If it is cut much sooner, the stems will be sappy



Clover on soil that has been limed.

and hard to cure. However, where there is a large acreage of clover to cut, it is better to start just a little ahead of full bloom, for it is better to cut clover a little ahead of the ideal stage than too far past it. Clover loses its feeding value rapidly. That is where many farmers are making a mistake in growing this crop. Not only will the hay have a much higher feeding value if it is cut at the proper time, but the next crop will be larger.

Handle the hay so it will reach the barn with the least possible loss of leaves, and the least exposure to the weather. The leaves, it should be remembered, are only about forty per cent of the crop, but they contain two-thirds of the protein, and that it what stockmen are after.

Let the hay wilt well in the swath, and then rake it. If it is to be loaded with a hay loader or gathered by a sweep rake, it usually is left in these windrows until it is ready to put in the stack or mow. Where there is a heavy crop, a tedder should be used on the hay before it is raked. Where rain falls, the hay then must be handled in the best way possible to get the maximum value that remains. And along this line remember this: There is more danger of "mow-burning" hay from the moisture on it than from moisture in it. Be very careful that you do not put hay in the mow or stack until this moisture has evaporated.

When the crop is raked before the leaves are dried out, the water in the stems will be drawn into the leaves and evaporated. If the leaves do get too dry they should be let lay until dew falls, and they then may be raked without a great loss.

Storing the Hay

In this century of the world's progress, there is little excuse for stacking clover hay. Money invested in hay barns or sheds will return a high rate of interest, for clover hay is valuable, and it does not turn water well when stacked. If it is necessary to stack the hay, make large stacks, for such stacks will keep the hay with a smaller per-

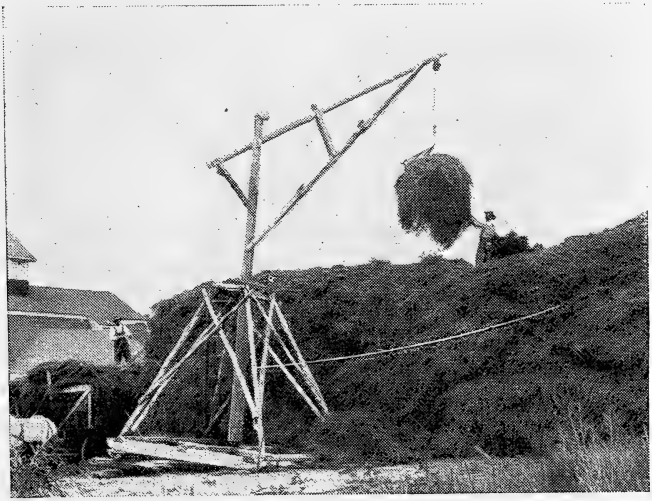
centage of loss than small stacks. Use a stacker. There are many stackers on the market that are good, and if you have a large acreage it will pay to get one. There are, however, some farms in rough sections where it is hard to use large stackers, because of the trouble in moving them. These farmers should use a pole stacker. Such a stacker may be constructed with little work or expense.

How to Make a Pole Stacker

In making a pole stacker, get a pole at least thirty feet long. This pole should be of timber that is light and strong. It is best to use cedar, but if you do use heavier timber, cut the tree two months before you will use it and put it up on supports where it will dry. Get three wire ropes about forty-five feet long, for guy wires. The pole is revolved on a wooden block that serves as the base, and which has been sunk into the ground ten inches. A piece of steel should be placed on top of the block to make the pole turn easier, and the pole should have a piece of a rod of half-inch steel on the end that will go into the block several inches. This will hold the pole in place on the block.

The guy wires are held on the top of the pole by a three-cornered piece of steel which has a place for wires to fasten in each corner. This steel should

have a hole in the center, and there must be a rod set in the upper end of the pole to go through this piece. The fork is attached to an arm bolted on the pole eight feet below the top. This arm should extend out from the pole twelve feet, with the outer



This pole stacker is on runners, and is harder to move over rough ground than the one described.

end slightly higher than the end at the pole. Fasten the outer end to the top by a logchain or wire rope.

Dig the hole for the block, and place the pole in shape to raise, with two guy wires fastened to stakes on opposite sides of the pole. Then hitch a

team on the third wire, and raise the pole. It is best to have the team hitched on a wagon that has a good brake, and hitch the guy wire to the wagon, for this gives better control, if it is desired to stop the pole at any certain place, for the weight of the wagon will aid in holding it.

While raising the pole, the arm on the pole will swing away from the team, and have a man take hold of the fork rope and hold it to prevent the team pulling the pole past center, and over on the wagon. There should be an extra stake driven into the ground so when the pole is pulled in position the end of the rope fastened to the fork can be pulled tight and fastened, and this will hold the pole until the guy wire which was used to pull the pole up can be taken from the wagon and fastened to a stake. While the pole is being raised, have a man stand with a crowbar at the base to prevent shoving it along the ground before it starts to rise. It is best to put the outer end of the pole up on supports, and place a stake under the guy wire you pull by before you start to pull.

Always use wire for the guys. Rope is uncertain and is apt to break. Have the wires long enough, and be sure the stakes are driven well into the ground. Having had the pleasure (?) of stacking hay when the pole fell down, the author gives

this advice from the heart. Use as light a fork as you can get, for lightness is much more important in the field than in a barn. Pull the forkful up with a horse, which a boy can lead. After the hay is in the air, swing it on the stack by revolving the pole with a crowbar run through a hole three feet from the ground. If the man who is handling the fork and the stacker will work together, they can place the hay on the stack where it is needed. They can build a big stack with but little more work than a small one.

The stacking outfit that has been described is not ideal where there is a large acreage of hay to be stacked, and here a more elaborate machine should be used if it is decided not to put the hay in a barn. But on many small farms, the expense of such an outfit is not justified, and on others the land is so rough that they can not be moved easily. This outfit is especially adapted for such farms.

After the stack is finished it should be covered with slough-grass or other coarse hay, which will turn the water better than clover hay.

When Clover Hay is Placed in the Mow

By far the best way is to place the hay under shelter. Just the reason for the continued stacking of a large part of the hay crop of the country

is hard to determine in view of the well-known fact that when the saving in the quantity and quality of hay is considered, one can pay the interest and depreciation on money invested in barns, and get back the principal in four or five years, and all of the rest of the time the buildings stand they will return net profit. In constructing a hay shed or barn, do not make the mow wider than twenty-eight feet, and twenty-four feet is better. If it is wider, the labor of mowing away the hay is considerable. The barn can be made as long as is

It is much cheaper to load clover with power.

needed. For use as a cattle or sheep barn, the method that commonly is used in the West is good. The hay in this type of barn comes to the ground, so there is no expense for a floor and heavy sup-

porting timbers. The sheds for stock are placed around the mow.

In placing the hay in the mow, do not pile it up more than is necessary. If you scatter the hay so it is not piled deeply, it will be possible to place it in the barn when it has a fairly high moisture content, and still it will come out in good shape. When the hay is placed in either the barn or the stack with too high a moisture content, there is considerable danger of spontaneous combustion, which will result in the whole proposition going up in smoke and flame. There is no doubt that this "sponifus combusts," as it sometimes is called, would be much more common, especially in mows, if there were air where the chemical action is going on. The charring of hay in either barn or stack is a common thing. Of course, the remedy for this is curing the hay properly. There is no excuse for having the hay heat. Charred hay has almost no feeding value.

As a feed for use other than for hay, J. M. Westgate, agronomist in charge of the clover investigations in the bureau of plant industry, U. S. Department of Agriculture, has this to say:

Red Clover for Ensilage

"Red clover may be so readily utilized as pasture or hay that as a rule to ensile it usually will

not pay; but if inclement weather ensues at the time of cutting for hay it is often advisable to ensile if the facilities are at hand. To make an ideal ensilage the crop should be cut a little earlier than is customary when cutting for hay, but early cutting is usually impracticable if hay is preferred, as the crop will be left uncut several days awaiting favorable haying weather. Although the uncured plants are heavy to handle, to ensile them presents the advantage of retaining all their leaves. If sweet silage is desired, it should be dried for an equivalent of three hours of good haying weather before being put into the silo. If a feed cutter is available, the clover should be cut before putting it into the silo. The second crop of clover when ensiled is best if mixed with some of the grasses or with Indian corn. The pure red clover silage is apt to be slimy. The more thoroughly it is packed down in the silo when filling the less likely it is to spoil.

Red Clover as a Soiling Crop

"Where pasturing is impracticable, red clover is often used as a soiling crop—that is, it is cut and fed green to live stock. Use in this way reduces or eliminates the danger from bloating which attends the use of red clover as pasture. It makes a good early feed, is palatable, and from six to ten tons of green feed an acre is not an unusual yield.

Red Clover for Pasture

"Red clover is a most excellent pasture for all stock, especially when they are growing. For pigs, it should be supplemented with a small grain ration, as this will induce much more rapid gains. The early growth of red clover is less nutritious pound for pound than when nearing or at the blooming stage, since in the early stages of growth it is high in moisture content, thus requiring the animals to eat relatively larger quantities. Furthermore, close, early pasturing is injurious to the stand of clover.

"Ordinarily, red clover will furnish some pasture during the first fall after spring seeding. It should not be too closely grazed at this time, for the succeeding season's hay crop may be decreased. The plants should be allowed to go into the winter with some growth upon the crowns to prevent their winter-killing, and also to enable them to store up material in their roots for an early, vigorous growth the following spring.

Bloating of Animals on Clover

"When pasturing cattle or sheep on red clover, care must be taken not to pasture when the animals are very hungry, especially when the red clover is young and succulent or when wet with dew or rain,

as bloating may result. Should bloating occur, several remedies are usually at hand which will afford

Herefords on a clover pasture in Missouri.

material relief. A large bit, the diameter of a pitchfork handle, may be tied in the mouth; a piece of rubber tubing may be passed through the mouth to the first stomach; or, as a last resort, the animal may be tapped to allow the escape of gas. For this purpose a trocar, such as is used by veterinary surgeons, is best; but in the absence of this a small-bladed knife may be used to make the incision about six inches in front of and slightly below the left hip bone. A straw or quill may be used to permit the

escape of gas. Care should be taken not to allow the straw or quill to work down out of sight into the incision."

Red Clover as a Feed

All farm animals require protein in some form in order to make their best growth or to produce the best results either in the form of milk and butter, as in the case of dairy stock, or as eggs, in the case of poultry. The ordinary roughage, such as corn stover and ordinary grass hay, is low in the necessary protein. On many farms this protein is supplied by feeding such concentrates as bran, oil meal, or cottonseed meal; but these concentrates are expensive and on most farms should be in large measure replaced by leguminous forage crops, such as red clover, which can be grown on the place.

Red clover is one of the most highly nutritious forage plants, either in the green state or cured as hay. This table shows the results of experiments to determine the relative values of several kinds of feeds. Here is the digestible nutrients in and the feeding value of red clover and other forage crops:

DIGESTIBLE NUTRIENTS IN AND FEEDING VALUE OF RED CLOVER AND OTHER FORAGE CROPS.

KIND OF FORAGE.	Dry matter in 100 pounds.	Digestible nutrients in 100 pounds.			Feeding value a ton.
		Protein.	Carbohydrates.	Ether extract (fat).	
	lbs.	lbs.	lbs.	lbs.	
Fresh clover	29.2	2.9	14.8	0.7	$ 5.96
Fresh alfalfa	28.2	3.9	12.7	0.5	7.00
Clover hay	84.7	6.8	35.8	1.7	14.12
Alfalfa hay	91.6	11.0	39.6	1.2	20.16
Timothy hay	86.8	2.8	43.4	1.4	9.64
Cowpea hay	89.3	10.8	38.6	1.1	19.76
Wheat bran	88.1	12.2	39.2	2.7	22.07
Shelled corn	89.1	7.9	66.7	4.3	20.16

Clover for Seed

There is considerable profit in growing the seed of this crop over large areas where it is not now grown. In order to make much success, every effort should be made to retard the production of the largest vegetable growth, as the conditions which favor just an average growth of the stems also favor maximum seed production. When the growth of clover is too rank, the crop will lodge, and there will be a light production of seed. The second crop is the one that usually is left for seed, and in many localities it will pay to cut the crop before full bloom, for the seed crop generally is of more value than the hay crop, and if the production of

seed can be increased materially, as it usually can, by cutting earlier than at the full bloom, it will pay.

The following has been condensed, in part, from a bulletin of the bureau of plant industry: The time of cutting the first crop for hay has a marked effect on the second crop, which is the one usually allowed to stand for seed. As already indicated, the best hay is produced when the crop is cut a little past full bloom; but this may or may not be the best time within a given section to cut the first crop, if due consideration is given to the production of maximum yields of seed where seed is relatively more important than the difference of a few days in the time of cutting the hay crop. For the sake of the succeeding seed crop, the first cutting for hay should be made a little before full bloom rather than after the first blossoms have begun to turn brown. As a specific instance it may be cited that mowing was commenced on one side of a 40-acre clover field when the plants were two-thirds in bloom. Several days were required to cut the field and the last of the clover was not cut until the plants were just past full bloom. The effect of this time of cutting on the seed crop was remarkable, in that the early cutting induced the second crop to produce seed at the rate of five bushels an acre, whereas the cutting a week later resulted in a seed

yield of only two bushels. The difference in the value of the preceding hay crop by reason of the early cutting on the one side was probably not more than 20 per cent, while its increase of the yield of seed was more than 100 per cent.

A number of conditions may arise which make it inadvisable to attempt to produce a full crop of hay if it is desired to produce a maximum crop of seed.

To Destroy Clover Insects

In the Ohio Valley States the ravages of insect enemies may be materially checked by pasturing clover or even by clipping it considerably earlier than is demanded by the hay crop, as this process tends to destroy insect enemies which would otherwise be developing to work havoc in the succeeding seed crop. In the northern portion of the northern tier of states, the short growing season will not usually permit the first crop to reach full bloom and still allow time for the maturing of a seed crop. For this reason, it is usually necessary to pasture the crop or cut it earlier than would otherwise be necessary.

If a full cutting of the first crop of clover is made for hay and the second left for seed, the seed yield is likely to be disappointing on account of the

lack of suitable growing weather for the seed crop. In the latitude of northern Michigan, the clover may be pastured until June 18 or 20 in normal seasons, and then be allowed to produce seed. If stock for pasturing is not available, the clover may be clipped back about the middle of June, with equally good results. Even when the land is pastured, it is a good practice to run the mower over the field after the stock is removed, to clip back any bunches which may be left by the stock. In this way, the seed crop will mature much more evenly over the entire field. The reasons for the increase of the seed yield due to clipping or pasturing back are not well understood. It is alleged that this brings the setting of the seed at a time when the necessary dry weather is apt to be prevalent. Another reason is the avoiding of injurious insects which would be present if the clover had matured a few weeks later.

Cutting for Seed

Red clover should be cut for seed when the heads have turned dark brown, and most of the seeds have reached the dough stage. If the heads are left much longer, they become brittle, and are apt to break off in harvesting. If you cut the crop with a mowing machine, use a buncher attachment fastened on the cutter-bar. An old-fashioned, self-

rake reaper is a good thing to cut the crop with, and probably is as satisfactory an implement as can be used. It usually will require at least four days, even if the weather is favorable, to cure the crop so it will be ready to hull.

A huller should be used to separate the straw, for the ordinary threshing machine will not do a good job. A huller is not an expensive proposition, and a man who owns a threshing machine usually is willing to buy one and hull the clover, after the rest of the season's threshing rush is over, if there is a large enough acreage. All chaff and straw usually contain some seed, even if the best methods have been used in handling them, and they profitably can be spread on clover fields where the stand is thin.

Utilization of Clover Straw

The clover straw after the seed has been removed is too coarse and unpalatable to be of much value as feed, though sheep and cattle will pick it over during the winter. The chaff may be used as an absorbent of liquid in stables. If the clover is cut for seed and cured without having been rained upon, the straw has some feeding value, but such instances are unusual.

Enemies of Red Clover

The principal enemies of red clover are insects, fungous diseases, and weeds. Occasionally, burrowing rodents, such as mice and gophers, do some damage, usually not at all serious. Of the enemies just mentioned, the insect pests are usually more troublesome than either fungous diseases or weeds.

Red clover is affected by a number of insects which at one time or another during its existence tend to destroy the life of the plant. Many insects feed to a greater or less extent on red clover, but comparatively few do enough material harm to affect seriously the production of clover over extended areas.

The Clover Root-Borer

For more than thirty years the clover root-borer has done an immense amount of damage in the clover-producing states east of the Mississippi river. This insect is especially destructive in Ohio, Indiana and southern Michigan. At one time this pest threatened the entire clover-growing industry of Michigan. The beetle has a hard body about one-sixth of an inch in length, and its color is dark brown. It is perhaps best recognized by the effect of the larvae on the roots of the plant. These insects do not materially damage the stand of clover

until the summer of the second year, because the roots must reach considerable size before they are capable of harboring the beetles. It is the larvae rather than the adult insects which work the actual destruction of the roots of the red clover. The only preventive measure yet tried is to turn down the clover stubble as soon as the hay crop is removed. At this time, the root-borers are in an immature stage and on being deprived of their food they perish, as they can not migrate. If this plowing is delayed until later in the fall, the larvae will have developed to the pupae and adults, and the plowing will have little effect on them.

Clover Hay Worm

The clover hay worm is a common pest in almost all parts of the country, and it is becoming more common. It works on hay in either the stack or the mow. It has been gradually spreading through the West in the last few years, and is much more common than it was a few years ago. Always clean the leaves out of the mow before putting in new hay, and never stack clover or alfalfa hay on old stack bottoms. If these preventative remedies are followed, there is little danger from the attacks of this insect.

Fungous Diseases of Red Clover

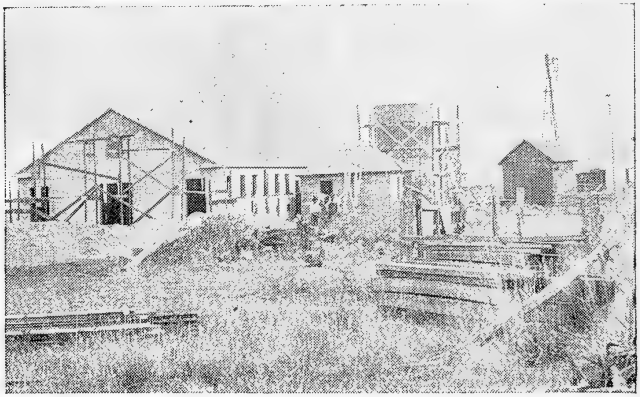
All the clovers are comparatively free from the plant diseases which so frequently prove disastrous to other crops; but in certain sections some of these diseases have proved serious, even to the practical elimination of successful stands.

A number of diseases attack principally the leaves of the red clover plant, forming large or small spots of various appearances. The clover leaf-spot appears as a multitude of small black specks on the leaves. The clover rust shows as small reddish-brown spots on the leaves. The powdery mildew develops a whitish mass somewhat like a cobweb across the surface of the leaves, and close inspection shows the presence of small black bodies within the meshes. None of these leaf diseases is usually very serious, and when the plants are growing vigorously they are usually able to thrive in spite of the presence of fungous diseases.

How About Mammoth Clover?

Mammoth clover is similar to the medium variety in many ways. It has, however, a larger and coarser habit of growth, but it is not so erect. It should be cut promptly, or the plants will become woody. In general, the hay is more bulky than that furnished by medium red clover, and it usually is

not quite so well relished by animals. It blooms later, and therefore it can be cut with greater ease on average corn-belt farms. It usually does not produce an important second crop. It has more value for improving the soil, for the roots go deeper,



Farm improvements pay if they are handled in an efficient manner.

and it furnishes more green material for plowing under, when it is desired to use the crop in this way. The crop will grow better where the moisture is deficient and where there is an excessive amount of sand than will medium red clover.

Alsike Clover

Where the land is excessively wet, there can be a larger yield of this clover obtained than with

either the medium red or the mammoth, but on average land, where these crops will do well, they are the crops to grow.

White Clover for Pasture

White clover is a perennial, and the stems creep along on the ground, and take root at the joints, so the plants are multiplied in this manner as well as by seed. It is especially adapted to growing in mixtures for pasture, and in some places as a pasture crop without mixture. The flowers are numerous, especially when wet weather is the rule about the time the plants are flowering. They are white, and tinted with a delicate rose color.

White clover is hardy. It comes out from under the snow with a green tint, and it is not readily injured by the first frosts of autumn. While it starts in the spring about the time the first frosts are off the land, growth is not rapid until the warm spring rains add the moisture that is necessary to produce maximum yields. After this growth begins, the flowers start. The blooming period can be prolonged by heavy grazing. Under average conditions, such as are found when the crop is being pastured heavily, it continues to bloom and form seeds well along in the summer.

The methods of seedbed preparation for this

crop are much the same as for red clover. It is a pasture crop, and therefore it is not a rotation crop. Considerable nitrogen is added to the soil by the bacteria that fix the nitrogen of the air on the roots,

A "toe-hold" tractor.

but it is not the equal in this respect to red clover. It is especially adapted to growing in mixtures for lawns, for when it is grown with bluegrass, for example, it adds nitrogen to the soil that will aid greatly in keeping the lawn in good condition.

CHAPTER V.

COWPEAS AS A ROTATION CROP

CHAPTER V.

COWPEAS AS A ROTATION CROP

Preparation of the Soil
Cultivation of Cowpeas
Harvesting Cowpeas
Harvesting Cowpeas for Seed
Cowpeas as a Catch-Crop
Cowpeas for Pasture
The Feeding Value of Cowpeas
Cowpeas for Silage
Varieties of Cowpeas

CHAPTER V.

COWPEAS AS A ROTATION CROP

Cowpeas grow in a wonderful variety of places and under many conditions. This crop is especially adapted to poor soils, and for soils of medium fertility. On very rich land, there is an excessive growth of vine that is hard to cure, and does not produce the highest quality of hay after it is cured. It often is possible to grow cowpeas on poor, heavy land where legumes like clover and alfalfa will not grow at all. This is true on many fields in the hardpan section of southeastern Kansas. The crop is a rank feeder, and is able to extract plant food that it is impossible for other crops to get. Another advantage is that is usually does not require all the effort that frequently is necessary to inoculate the soil for alfalfa and clover. Whether the bacteria that fix nitrogen on the roots of cowpeas always are present in land, or whether they adhere to the seeds is not known, but it is not necessary to inoculate for the crop in any case. Tubercles will be found the first year the crop is grown on new land.

Preparation of the Soil

Prepare the seedbed for cowpeas carefully. Too often, cowpeas are just "scratched in," for they must be planted in the late spring when there usually is a rush to get other farm work done, and they frequently are neglected. The land should be

General farmers would make more money from their crops if they were as careful with the cultivation as fruit farmers.

just as well prepared as for corn. If fall plowing will do in your section, plow the field then, and disk it in the spring, just before the crop is planted. In any case, be sure the field is free from weeds at the time the seed is sown, so the cowpeas will have an equal chance with them.

Whether the seed shall be drilled in thickly, or whether less seed shall be drilled and the plants

cultivated, is a question that often is hard to decide. Much less seed is required where the field is to be cultivated, and the yields frequently are superior to where more seed is planted, and the plants are left to shift for themselves. Probably it usually will pay to cultivate cowpeas where the work is arranged so the crop can be cultivated when it needs it. If it cannot, the seed should be drilled thickly, and no effort made to cultivate. Too often, cowpeas that are to be cultivated are neglected in the rush of the summer's work, and where this is the case, weeds come up in the ground that is not occupied. This would not happen if the seed had been planted thicker. So, if you have time to cultivate the crop, plant from three to four gallons of seed to the acre. If the crop is not to be cultivated, sow from four to five pecks. Plant the crop with either a corn planter, equipped with special plates for sowing cowpeas, or with a wheat drill, with some of the holes stopped. If the machinery is properly adjusted, the seeds may be planted without many being split. The ordinary width of a corn planter, three feet six or eight inches, is too wide to plant cowpeas. Thirty inches is about right, and this width can be obtained by stopping up some of the holes in a grain drill. Where the seed

is drilled with a corn planter, and the crop is not to be cultivated, straddle the rows.

Cultivation of Cowpeas

If the ground is thoroughly warmed, and the seed never should be sown until the ground is in this condition, the plants will start rapidly. If a rain falls soon after the crop is sown, it may be necessary to break the crust with a harrow, to let the young plants through. Never use a harrow after the plants have come up, for they are tender, and easily broken. And bear that in mind when you are cultivating the crop, too. The plants must be handled carefully, or they will be broken off. It is possible, under many conditions, to use the weeder or harrow on young corn with considerable profit, but it is not possible with cowpeas. The crop should be large enough to cultivate in from 15 to 20 days after it is planted.

Disk cultivators are not adapted to cultivating this crop. Shovel cultivators are perhaps best. About three cultivations usually should be given. If the plants are intended for seed production, cultivate just before blooming, and then quit. Nothing is to be gained by later stirring of the land, for it merely increases vineing that does not aid in seed production.

Harvesting Cowpeas

Perhaps most of this crop still is cut with mowing machines, and this is the most practicable way, too, for a man who has a small acreage. For those who have a large acreage, it would be better to buy some of the special types of pea harvesters. There are several that are good, and they are not expensive. This crop ripens rather unevenly, so it cannot be cut for any purpose when all the plants are at the right stage of maturity. The crop should be cut for hay when the pods are fairly well developed, and some of the leaves are turning brown. This crop is one of the most difficult of the legumes to cure properly. The stems are so large and they contain such a great amount of moisture that to get the hay in proper condition without a great loss of leaves is a serious problem.

Rake the hay after the plants have become well wilted, but do not allow the leaves to become cooked. Let them lay in the windrow for about a day, and then shock them in small shocks. Then comes the curing process. Here is where most growers make their great mistake. To a man who is used to quick-curing timothy or prairie hay, it seems to take an immensely long time for the stems to get down to the proper moisture content for storing, and he almost always will stack or put cowpea hay

in the mow too green, for the first few times. The stems dry slowly, and frequently it takes a week or more of good weather to cure the hay properly. Be certain these stems are well cured before you move the shocks, and then you had better wait a day or two for good measure, for it is probable that you have missed it, especially if this is the first time you have grown the crop.

This is one crop that it is better to stack in small stacks, if you do not have room for it in sheds. Of course, it will keep better, if it is well cured, in large stacks, but small stacks always are the safest because of this danger from heating. Cover the tops with slough grass when they are finished. If the hay is stored in a mow, it should be spread out as much as possible, for cowpea hay that is piled up much usually will mow-burn.

Harvesting Cowpeas for Seed

One of the things that is hard to understand is why more farmers do not grow cowpeas for seed. The price has been high for years, and it probably will continue high, as the demand for seed is increasing. The peas must be threshed on a special thresher, it is true, as ordinary threshing machines will break them badly. These machines do not cost very much, and they are easy to run. Cowpea seed

production usually is profitable, and the limits of the area of seed production may easily be extended northward from where they now are.

The pods ripen unevenly, and when the field has reached the best stage for cutting, there still will be some of the plants that have green pods. The only rule to go by is to pick the time at which most of the pods are ripe, and then cut the crop.

The weevil gets into cowpea seed quite badly, sometimes, and considerable care must be used in regard to this pest, both when one is storing seed and when purchasing seed. The weevil is very easy to kill, by fumigation, so all that is needed is a little

Jersey cow with a record of 1,031 pounds of butter in one year.

care in handling the seed. If the weevil bothers, fumigate with carbon bisulphide at the rate of one pound to every 600 cubic feet of space. When this fumigation is done, place the seed in a bin as near air-tight as possible, so there will not be a great loss of gas. Merely place the material in a shallow dish on the cowpeas; it is heavier than air, and it will evaporate and sink into the seed, and kill the insects. If a canvas cover is thrown over the seed, it will hold the gas into the seed better.

Cowpeas as a Catch-Crop.

Cowpeas can be used as a catch-crop after wheat in localities not too far north. One method of seeding that has been used at the Kansas station with considerable success is to drill cowpeas after the wheat is cut, and to have the drill follow the binder. This method is all right, if the soil is not too heavy, and if there is plenty of moisture in the ground, so the seed will germinate and get started properly. The only reason for planting cowpeas at this time is to save the week or more that must elapse until the shocks are removed from the field. Usually, there is enough time to plant the crop after that, however.

When the cowpeas are plowed under as a green-manure crop, they add a great deal of humus and

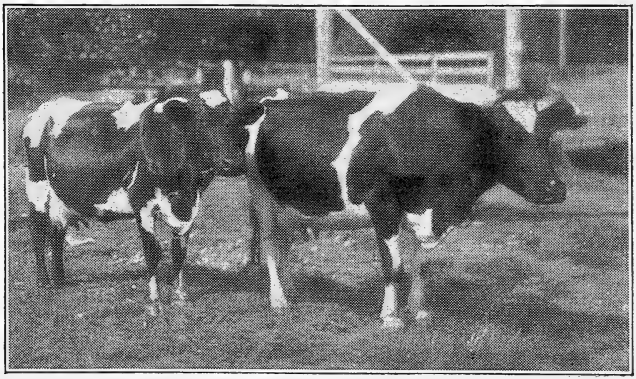
nitrogen to the land. One of the important things about their use as a green-manure crop is this: Cowpeas do not cause a great formation of acid in the land, as does cane, for example, and therefore it is a much better crop to use for this purpose, especially in non-limestone sections. But even if the crop is harvested for hay, there is a considerable amount of nitrogen added to the soil. The nodules on the roots of cowpeas usually are large.

Cowpeas for Pasture

On account of the fact that cowpea stems are easily broken and that the crop does not form a sod, it is not naturally a pasture crop, but it can be used for this purpose, sometimes. Take, for example, as a hog feed to aid other hog pastures, when they are cut short by the summer's heat, it has considerable value. And it also can be used to supplement other pastures at that time, if considerable care is used in turning the animals in on the crop. Usually, however, hogs are the only farm animals it will pay to pasture on cowpeas.

In semi-arid sections, it often is possible to raise cowpeas where most other common legumes fail. There should be a great extension of the acreage in wheat sections.

In all sections where cowpeas will grow well, they produce profits that rank up well with all standard farm crops, and exceed them in many



Holstein cows can make profitable use of great quantities of roughage.

cases. The price of seed ranges high, and that is about the only thing that is preventing a great extension of the growth of this crop.

The Feeding Value of Cowpeas

Cowpea hay compares favorably with alfalfa hay, when it has been cured properly. It is especially valuable as a feed for dairy cattle, and for young animals. If an annual leguminous crop is to be grown, cowpeas should be the crop, where they will do well.

Cowpeas for Silage

This crop has not been used much for silage in the North, but its use is more general in the South. There is a field for the extension of the use of this crop for the silo. When the cowpeas are to be put in a silo, the crop should be allowed to become nearly ripe, and then be handled immediately on cutting, to prevent shelling and loss of leaves.

It is a common and successful practice in the South to plant cowpeas in corn rows at the last cultivation, and cut the entire crop for the silo, thus furnishing a more balanced ration than does corn silage alone. The weight of the corn in this mixture will furnish sufficient pressure to prevent an excessive loss in the cowpeas. Under such conditions, the yield of forage will be considerably increased, and the quality of the silage will be improved.

The Maryland Experiment Station reports as follows the results of investigations regarding cowpea silage:

"In making silage, the peas should be cut at the same stage as for hay. They are cut with a mowing machine, and are raked up and hauled in at once and may be put in the silo without cutting, but, of course, the crop will take up less space and pack closer if it is run through a cutter. Cowpeas

may be put into the silo with corn. For this purpose, it is well to run them through the cutter, so they will be mixed about one-third peas and two-

While cowpeas usually is used for hay, the crop is placed in silos with good results in some sections.

thirds corn. Cowpeas should yield from six to ten tons of silage an acre. Cowpea silage is quite different in appearance from corn silage. It becomes

darker, and does not have quite so pleasant an odor. It contains less acid than corn silage."

Varieties of Cowpeas

The Kansas Station has carried on tests of the yields of cowpeas for many years, and the following table gives the average results obtained for a series of years:

Variety	Days to Mature	Average acre yield Grain	Hay
		Bu.	Tons.
Mount Olive	114	10.73	2.68
Whippoorwill	111	11.46	2.63
Gray Goose or Taylor	113	11.86	2.47
Hammond's Black	114	11.13	2.23
Black Eye	111	12.71	2.17
New Era	107	12.44	2.14
Michigan Favorite	107	11.23	2.10
Warren's New Hybrid	107	13.46	2.06
Old Man's	108	11.49	2.03
White Giant	108	10.81	1.95
Clay	108	10.86	1.94
Warren's Extra Early	107	10.80	1.87

These results would hold good, of course, only for the Kansas section. The relative order would tend to change from place to place, to a certain extent.

CHAPTER VI.

CORN GROWING FOR PROFIT

CHAPTER VI.

CORN GROWING FOR PROFIT

Select Your Seed Carefully
Test Every Ear
Soils for Corn
Plow the Land in the Fall
The Rate of Planting
Variety Names Are Not Certain
The Cultivation of Corn
Will it Pay to Build a Silo?
Kind of Silo to Build
Silos Are Not Expensive
Capacities of Silos
Feeding Value of Silage
In Regard to Shredding Stover
The Cost of Shredding
Shrinkage of Corn
The Weight of a Bushel of Corn
Prevention of the Smut of Corn
Insect Enemies of Corn
How to Judge Corn

CHAPTER VI.

CORN GROWING FOR PROFIT

Corn—or maize if you prefer to call it that—is the most important crop of the United States. In the Middle West it is about the only crop grown in some sections. Its influence on animal types has been remarkable, and is responsible for lard hogs. These were developed and now are grown because they are adapted to the peculiar conditions of the corn belt. Corn is high in carbohydrates, and a rotation high in this material has developed the lard hogs until they are markedly unlike their ancestors.

Select Your Seed Carefully

There has been more foolish contention on one hand and more almost criminal neglect on the other, in regard to the selection of seed corn than in regard to any other thing in farming, in recent years. What is needed is the selection of corn on a practicable, scientific basis; which means the discarding of crib selection on one hand and all this rot about "bloodlines" on the other. Many farm leaders have lectured in deeply technical terms

about elaborate methods of field seed corn selection, with the result that crib selection still is the prevailing method on an appallingly large number of farms.

It is a simple and easy matter to gather and properly care for seed corn, all contentions of dreamy scientists to the contrary. There is no need for freakish concern over minor details. All that is needed is the selection of good ears from good stalks, and then these ears must be cared for so they will germinate well. The best way to select seed corn is to go into the fields several weeks before you shuck corn, select the ears, and place them in a sack. Some men leave part of the husks on the ear, but this is not necessary unless it is desired to hang these ears up by the husks.

Many farmers use a simpler method, and select the ears at husking time, having a box on the wagon in which they throw the ears as soon as they are husked. Usually good results may be obtained with this method; but as cold weather will seriously injure the seed if it contains a high percentage of water, it is best to select the ears in the field earlier, so the water content may be lowered before cold weather arrives. But no matter what method is used, consider the stalk on which the ear grew. If the stalk is not normal, or if the ear is improp-

If one takes time to select seed ears when he is shucking the corn, it takes too much time. The best way is to go through the fields with a sack before husking time.

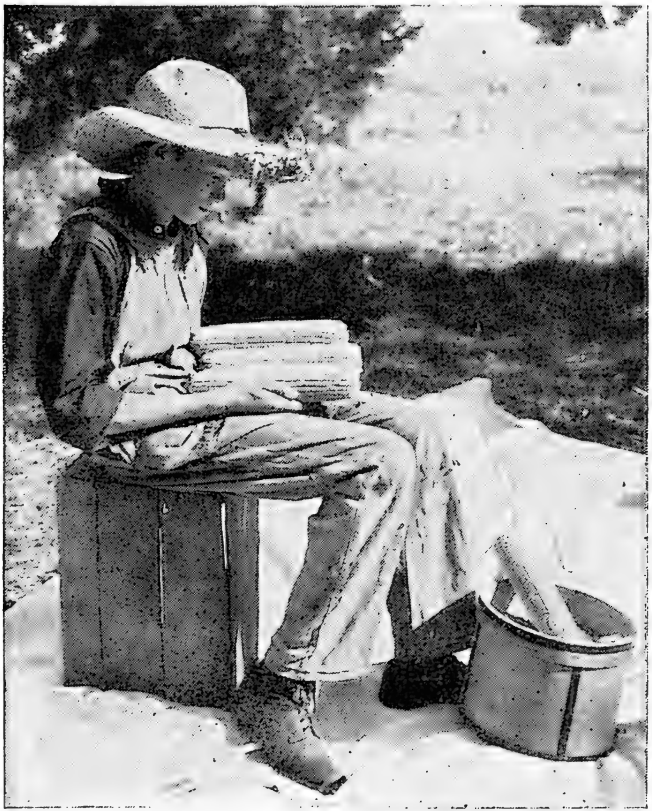
erly placed, do not save the ear, no matter how good it may be.

Cure the seed promptly after it is gathered. No temperatures known in the corn belt will injure seed corn that is properly cured and stored, and yet this is one of the main causes of poor stands. As soon as the ears are gathered, place them in drying racks so the air will circulate around them readily. It does not matter where these racks are placed, so long as they are under shelter. It formerly was the common practice to store the ears in the attics of farm homes, and when the mice are kept away from the seed, this method has not been improved. Farmers with several hundred acres of land planted to corn can afford to have a seed house, but this is not essential for those who have smaller acreages. And the type of rack is not especially important, just so the ears are stored so they will dry out well.

Test Every Ear

About twice as much corn should be selected as will be needed, and every ear should be tested. Discard the poor ears. There are many good ways to test seed corn. The most essential things are that the temperature be kept at about 80 degrees F., and that the seed be kept moist. Sand is a good medium in which to germinate seed corn. If it is

desired to test many ears, take a small, shallow box, and divide it into compartments with wires. A box with ten wires strung both ways, thus dividing the



Preparing for the county corn contest.

box into 100 compartments, is a good size. Remove six kernels from every ear, and then place the ears, for ready reference, in just the same position in which the compartments containing the kernels are. Select two kernels from the tip, two from the middle and two from the butt of each ear. Keep at the proper temperature, and if more of the kernels than one fail to germinate at the end of five days, the ear should not be used for seed.

This testing of seed is one of the most important things in the whole seed corn proposition Many fields, even in the best sections of the corn belt, often do not have more than 80 per cent of a stand, and sometimes the stand is much poorer than this. A large acreage always is replanted every spring, at a considerable cost both in labor and often in reduced yields, when this loss could have been prevented, if the seed had been tested and the poor ears discarded. Testing seed is the only way to tell whether it will germinate well. It is impossible to tell whether a kernel will grow by looking at it—yes, that statement will be disputed, but it is a fact. If you do not test seed, it is certain you will plant many ears that will not germinate well. The proper way is to find these ears, so they need not be planted.

Soils for Corn

Rich, deep loam soils are especially adapted to corn, but the plant will produce profitable crops on a great range of land. Good drainage is essential, for the plant cannot grow where the soil contains much gravity water. The nitrogen content of the land is of great importance, for on most fields of this country, nitrogen is the limiting element in the

On steep slopes water aids in soil formation the fastest.

yield. Usually the yield is determined by the nitrogen content. That is why frequent introduction of leguminous crops in rotations with corn is of great importance. Keep up the nitrogen supply.

Corn is not especially "hard" on land. It removes a comparatively small amount of mineral

matter from the soil, the principal element being phosphorus. But just because the crop does not reduce soil fertility is no sign it should be grown long without a change as is the case in many parts of the West. Rotate the land properly, and do not grow corn on the same land more than two years in succession. In many parts of the West, corn is grown on fields without change, for many years. The author knows of fields in Kansas that have been planted to corn every season for the last thirty years, but still the owners go gamely ahead and plant corn every spring, even if the yields give returns that are below the cost of production.

On account of the great need of available nitrogen for this crop, it usually should be grown as the first crop on land after the nitrogen-supplying crop has been grown. It is the common practice to plant corn after a crop of alfalfa or clover has been plowed under. It is impossible to get too much nitrogen, under ordinary field conditions, for corn. Wheat easily may be injured by too much nitrogen, which causes the grain to lodge.

Plow the Land in the Fall

Plow all the land for corn in the fall that is possible, unless fall plowing is not advisable in your section. Fall plowing will increase the supply of

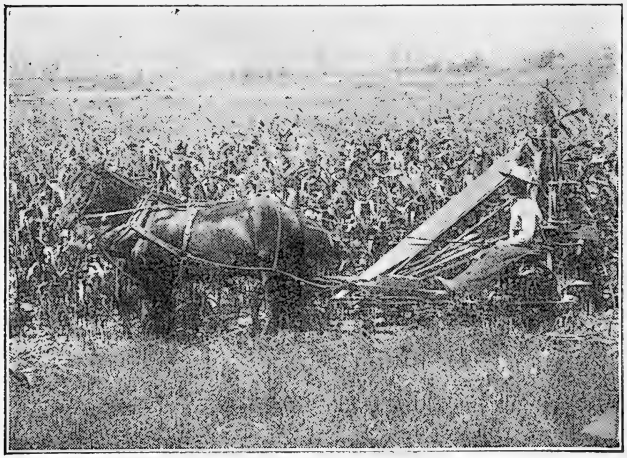
available plant food, conserve moisture, and more important yet, it will allow the cold and wet weather to destroy insects, and their eggs. This last is of much greater importance than most corn growers are willing to admit. Fall plowing will destroy the protection the insects and the eggs have, and they will be destroyed. Always remember this about the insects that attack corn, and most other crop insects for that matter: The best way to aid in controlling them is by a good rotation of crops, and by fall plowing.

Most land that is to be planted to corn is not plowed deep enough. On account of lack of available power, there always is the temptation to run the plow much more shallow than it should be run when one is preparing the soil for this crop. In comparison with wheat and oats, the seedbed should be prepared deeply. While the proper depth will vary with the soil, subsoil, season, climate and previous crop, a good depth for plowing is six inches and frequently deeper. When the ground is plowed at a lesser depth, it is probable the yield will be reduced. Plow deep for this crop, in the fall and winter when the teams can stand the work well.

The corn crop of this country will be increased markedly when power plowing outfits are used to a greater extent in small fields. When machine

power is used, farmers always are more willing to put the plow into the soil deeper than when horses are producing the power.

Subsoiling for corn has been tried by a great many growers, without much results. In some



In the Kansas River Valley.

cases, there has been a small increase in yield, in others a small decrease, but in no case has the change been of any great importance. In general, the results have indicated it does not pay to subsoil for corn.

Preparing the Ground After Plowing

Fall plowed land should be left until the next spring without any further work, as this will allow it to become weathered, and to absorb moisture. But in the spring, the land should be harrowed soon after it is plowed. When the soil is dry, the harrow should be used on the ground that has just been plowed, at the close of every half-day. In extreme cases, it may be necessary to hitch to the harrow and break up the clods at the middle of a half-day's work. This breaking up of the soil is essential, for the plant food in clods can not be used. Crush them and give the corn a chance. A deep seed-bed, with the clods pulverized, should be the ideal of ever grower.

Then comes the planting. Usually, the difference in yield between surface planted and listed corn is not very great. But under some conditions, such as on the sandy, prairie soils of western Kansas, listed corn will give the best returns. As an average of the tests at the Kansas Station, on the farm at Manhattan, there has been a difference of about two bushels in favor of listed corn. On the other hand, on thin, heavy soils, top planting often will give the best returns. How to plant corn will ever be the individual problem of farmers.

The depth of corn roots is not materially af-

fected by the depth of planting. Therefore nothing is gained by deep planting, and if the seed is planted too deeply, much of the energy of the plant must be exhausted before it comes up. If the seedbed has been well prepared, from one to two inches is the proper depth to plant corn. The time of planting will vary, of course, with the locality, but in general there is no reason for planting the seed before the land is warmed thoroughly. Much corn is planted too early. In Illinois, for example, the best results are obtained from planting corn from May 1 to 15.

The Rate of Planting

The rate of planting will vary with the soil, and the purpose for which the corn is to be grown. Corn intended for silage should be planted thicker than that intended for maximum grain production, although this may be overdone. Where corn is planted too thick, the percentage of protein is materially decreased, and the percentage of crude fiber increased. The amount of seed should be determined by the fertility of the soil and the purpose for which the plant is to be grown. In the corn belt growers usually aim to get about three grains in the hill, the rows being three feet six inches apart both ways. On poorer soils the planting should be thinner. Experiments indicate there

is no appreciable difference between the average yields of drilled corn and that planted in checks, where the same amount of seed has been used.

Drilled corn cannot, of course, be cross-cultivated except when young, when the harrow or weeder may be used, and in foul fields it is difficult

There is a big waste of both stover and grain when the shocks are left in the fields until late in the winter. The most economical way to handle this material is to shred it and put it under shelter.

to keep free from weeds. But hilly fields ought always to be drilled, for if they are checked, soil erosion is greatly facilitated. In such fields, the

rows should run at right angles to the slope of the hill.

Checked corn is more easily kept clean, being capable of cultivation both ways with all kinds of standard cultural implements. Experience in growing corn, planted both ways, and extensive observations confirm the general belief that the method of distributing the seed does not influence the yield except in unusual instances. It is the number of stalks an acre which determines the outcome.

Upon the use to which the crop is to be put depends the distribution of the seed. Corn for forage, soiling purposes or the silo may be planted thicker than that intended for high-class seed or the production of large, well-developed ears.

It takes a little more than a bushel of fifty-six pounds of seed to plant eight acres where the hills contain three kernels and are forty-two inches apart both ways. A dozen good ears will plant an acre. With a good team, long rows and a square field from ten to fifteen acres a day may be planted with a checkrower.

When corn is planted forty-two inches apart each way, there are 3,556 hills an acre. One small ear to each hill will make a yield of about thirty-five bushels. It is obvious that many growers do not get even an average of one small ear to the hill.

Variety Names Are Not Certain

The nomenclature of corn varieties is in such chaos because of mixing of names by seed-corn dealers and the mixing of varieties by cross-pollination effected by the wind, that a varietal name is of little significance in comparison with the vigor, productiveness and purity of the seed. The Leaming is as constant and well recognized a variety as exists, yet seed ears purchased under this name in Connecticut or New York are, in appearance and productive ability, usually as unlike ears of Leaming purchased in Ohio or Illinois as they are unlike ears of other varieties.

In purchasing seed corn it is wise to give much more attention to the productiveness of a variety, its uniformity, and its adaptability to the soil and climate where it is to be grown than to the varietal name. A variety or strain can be rendered exceedingly productive by proper breeding, but if neglected it soon deteriorates. Careful breeders of productive strains of corn are needed in every community. When you purchase seed corn, always buy it on the ear, for you know then just what you are getting. There is a good chance to sell inferior seed after it is shelled, but such seed can not be "put over" when it is on the cob.

The Cultivation of Corn

Corn should be cultivated with due regard to the growth of the roots. Cultivation should be deep and close to the stalks at first, and should be more shallow and farther from the corn as the season advances. Cultivate corn whenever the plants need it, and they need cultivating when a crust has formed on the land. Usually it will pay to cultivate corn with a weeder or a harrow before it comes up. A peg-tooth harrow is a good implement for this purpose.

The first cultivation is the most important. Take plenty of time on this cultivation, get close to the corn, and kill the weeds that are just starting. It is easier to kill them at that time than later. You can get just about as deep and close to the corn at this time as you wish, and it will not hurt anything, unless you actually plow out the little plants. After this first cultivation, get farther and farther away with each succeeding cultivation. The last two should be shallow, and far enough away so the roots are not cut.

But if wet weather comes, and weeds and grass "get ahead" of the cultivator—as weeds and grass sometimes will do—corn growers should forget all about roots, and put the shovels down deep enough to destroy this growth. You will damage the corn,

To produce corn like this, one must cultivate it well.

all right, by doing this, but the weeds will hurt it worse, so the logical thing is to take the lesser of the two evils. The tools used in the cultivation of corn should vary with conditions, so the work may be done properly. Shovel, disk and surface cultivators all have their advocates, and all are good, and have their place. If shovel cultivators are used, they should be equipped with small shovels, so these may be used toward the last of the season. Small shovels are better for shallow cultivation than large shovels, but the big shovels should be used at the first of the season.

Usually it will pay to continue cultivation after the corn is too large to cultivate with two-horse cultivators. If the ground still is free from crust and weeds it probably will not, but if a crust has formed, or if there is much of a growth of weeds it will. Use five-toothed cultivators. They will break up the soil mulch, and conserve the moisture just at a time it is badly needed.

There are many ways to harvest corn. The method that is attracting the most attention is by the use of silos. Usually, more profit can be made from corn fed as silage than when fed in any other way. As an aid to meat and milk production, silos are in a class by themselves.

Will it Pay to Build a Silo?

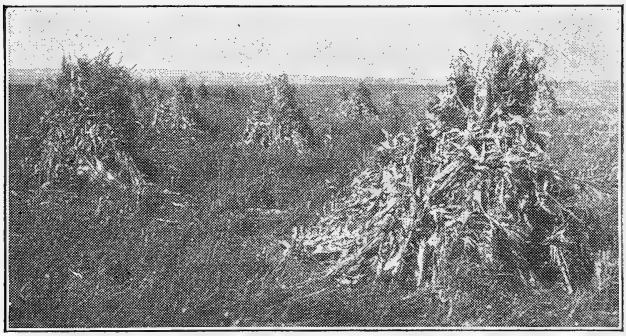
The owners of valuable land can not afford to keep much of this land in pasture. Silos are essential where stock farming is practiced on high-priced land. They return profits everywhere the silage is fed properly.

A silo will be a profitable investment if you keep ten head or more stock on your farm. What return can one get from the money invested in a silo? Well, on an average, corn silage can be put into the silo for about $2 a ton, including all of the cost of growing the corn. If you feed this silage in an economical way to farm animals, you should get a return of at least $4.50 a ton. Many higher returns have been reported; for example, the animal husbandry department of the Kansas Agricultural College made a profit of $5.65 a ton one winter on silage fed to fattening cattle. If one can produce a feed for $2 a ton and feed it to animals so it will produce $4.50 a ton, a silo is a mighty good investment.

And here is another thing about a silo that is important: Corn is cut for silage when it is in the "dough stage," after nearly all the kernels are dented, and that is the time the crop often is badly injured by drouth. The use of a silo often means the saving of the full feeding value of the corn,

while many times it would be cut to a half crop by dry weather.

Not more than 60 per cent of the feeding value of the corn crop is in the ear, and if only the ears are harvested, you have a 40 per cent waste in the handling of the crop. If you merely pasture the

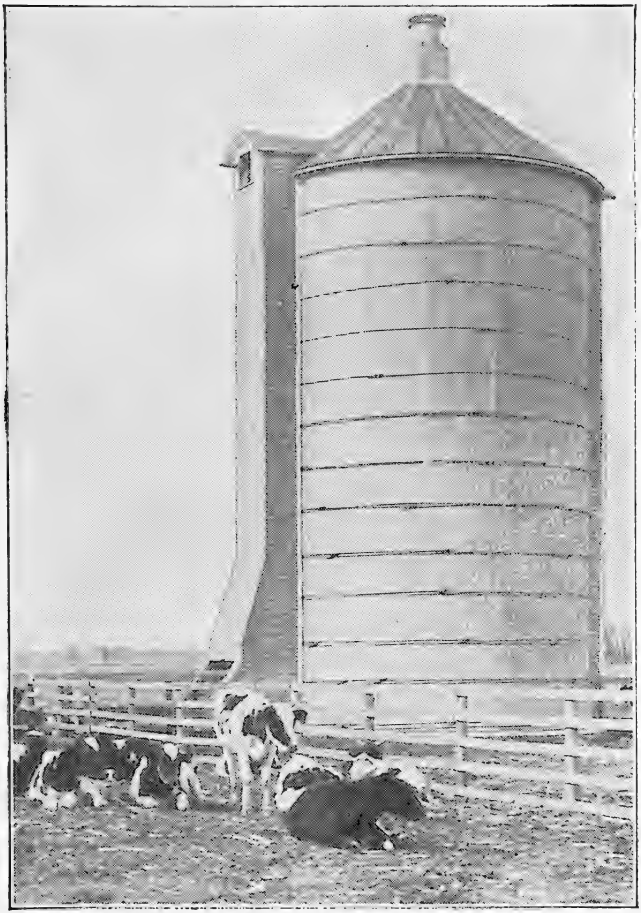


A corn field in December.
The fodder is losing feeding value rapidly by weathering.

cornfields, the crop has become so weathered by the time the corn is shucked that it does not have a high value. If you do not believe that, just find out the average price of cornstalks in your community, and compare this price with the value of the grain. It makes a very small per cent.

Kind of Silo to Build

All makes of silos have their advocates, and all the standard types will keep silage about equally



Sentinels of prosperity.

well, if they are well constructed. There is nothing to the idea that some makes of silos will keep feed better than others, and the thing you have to consider in building a silo is the cost, probable life and maintenance expense. Usually, a well-constructed solid-wall or metal-lath cement silo will be the cheapest in the long run. If they are well built, they will last a lifetime. Stave silos keep silage well, when they are well constructed, but their life usually is not nearly so great as the cement types.

The thin-wall, metal-lath cement silos must be built by men who are experienced in the work. The solid-wall type of silo may be put up by men who are less experienced; the farmers and their hired men can do the work if they will carefully follow the plans and specifications for the building of this type. The agricultural colleges of Kansas, Missouri, Iowa, Wisconsin, Illinois, Pennsylvania and most other states will furnish full plans and specifications for the construction of cement silos, and usually you can get them to send a man to help you put up the silo, if you desire. If you wish to put up a silo, no matter what type or kind you select, write to your agricultural college and get expert advice.

If you desire to erect a stave silo, the company you purchase the silo of usually will put it up on

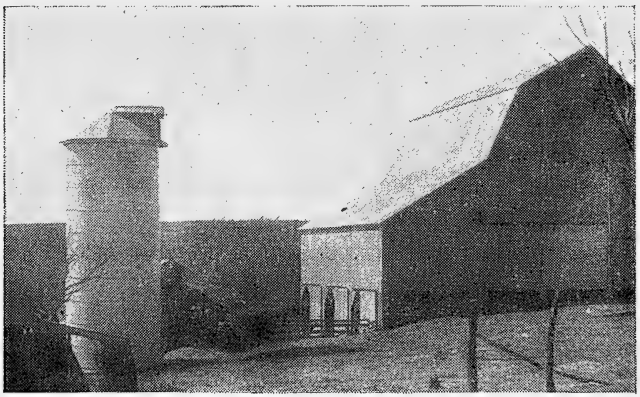
the farm complete, so the labor of erecting the structure need not be done by the farmers. In southeastern Kansas and in other places where bricks are cheap, many farmers are putting up brick silos, and are finishing them inside with cement. A good silo can be made from brick, and in many places where the bricks are cheap this is the type to construct.

Silos Are Not Expensive

You will have to get the forms for the solid-wall silo, and it will make the cost of this phase of construction much cheaper if you get several of your neighbors to build silos also, so the cost of the forms may be divided among all. If you cannot get your neighbors interested in the matter, usually the forms may be rented from a contractor. The cost of a silo is not great. Ordinarily, the cost of a solid-wall silo, sixteen by thirty feet, will be not far from $9 for every foot of height, but, of course, it will vary with the cost of the materials and labor, and the distance of the farm from town. Such a silo will cost about $300, perhaps a little more, if constructed by a contractor, and if the farmer uses his own labor and cuts out the contractor's profit, he usually can build the silo much cheaper. A silo of this type will hold 120 tons of silage. Such a

silo is proof against fire and winds, and it can not be moved by anything except dynamite.

In building a silo, remember these facts: The walls of a silo must be absolutely airtight, and they should be at least twice as high as the diameter, and the inner wall must be smooth. The top of the



Good barns and silos usually are found together.

silage will spoil, and form an air-tight cap over the rest of the feed. If the stalks are very dry when you harvest them, add water as they are placed in the silo. Cement silos always must have proper reinforcement, while stave silos should be anchored with guy wires. Never use paint on the inside of a stave silo, but instead use linseed oil or creosote.

A roof is not necessary for the keeping qualities of the silage, but one always should be constructed. A good time to put on the roof is when the silo is filled the first time, as then the men have something to stand on, and they do not have to construct a platform.

It does not take long to fill a silo and it is best for several farmers to go together in buying a silage cutter to reduce the cost. The cutters will cost from $90 to $300, and sometimes more, depending on the size. Use any available power to run the machine.

Capacities of Silos

The capacity of a silo increases rapidly with the diameter. Here is a table that shows this increase:

TABLE GIVING THE APPROXIMATE CAPACITY OF CYLINDRICAL SILOS FOR WELL-MATURED CORN SILAGE, IN TONS.

	Inside Diameter in Feet.					
Depth, feet.	15	16	17	18	19	20
25	80.62	89.64	103.6	116.1	129.3	143.3
26	85.45	97.23	109.8	123.0	137.1	151.9
27	90.17	102.6	115.8	129.8	144.7	160.3
28	94.99	108.1	122.0	136.8	152.4	168.9
29	99.92	113.7	128.3	143.9	160.3	177.6
30	105.0	119.4	134.8	151.1	168.4	186.6
31	109.8	124.9	141.1	158.2	176.2	195.2
32	115.1	135.9	147.8	165.7	184.6	204.6

In this table the horizontal lines give the number of tons of silage held by a silo having the depth given at the left of the column.

Feeding Value of Silage

As to the feeding value of silage: For many years, about the only extensive use made of silage was feeding it to dairy cattle. Its use is spreading until now it profitably is used for almost all farm animals. In addition to the food in the silage, the green feed tends to keep the animals in fine condition, and usually a higher quality of beef can be produced by the use of silage than without it.

Silage is valuable for chickens, to encourage winter egg production. Many fruit farms carry a large number of hens in connection with their fruit work, and in the winter, egg production is where

Shucking shock corn is hard work. A shredder would have done this work much easier and cheaper.

much of the profit from chickens comes in. If the hens are furnished with silage every day in winter, it invariably will increase egg production. So important is silage for chickens that some men who have no silo prepare small quantities of silage in barrels, exclusively for the use of poultry.

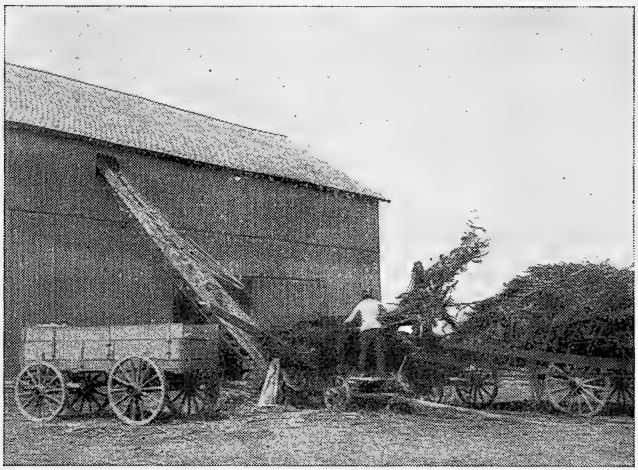
Because of its bulky nature, silage is not adapted as a feed for fattening hogs, but it is valuable as a feed for brood sows. Be very careful in feeding moldy silage to cattle, and never feed it to horses under any circumstances.

Much of the corn, especially in the West, still is shucked in the field, and the stalks are pastured. Of course, it is unnecessary to say this method is wasteful, and should be discarded. An increasing amount is being cut and shocked in the field. That helps in saving the full feeding value, although it is not so efficient a method as making silage out of the crop.

In Regard to Shredding Stover

Shredding stover actually increases the feeding value of the material. Prof. Henry, of the University of Wisconsin, has conducted feeding tests which show that shredding corn increases its feeding value 24 per cent above that fed to cows in its uncut form. In addition to this, considerable feed-

ing value is lost by the stalks standing in the fields, and this is saved when they are shredded. This loss may amount to as much as one-fourth, if the shocks are left out as long as two months, and they are, on an average. Shredding is not so economical a



Shredding corn. This is the way to handle the part of the corn crop that is not placed in a silo.

method of saving the feed as by the use of a silo, but it is a far better method than when it is fed as shock fodder. You can be certain that no cow will give a maximum amount of milk, and that no steer will make the most economical use of the feed, if

the fodder is shoved at them as an armful of stalks covered with sleet and snow.

And there is the matter of the manure to consider, which is an important factor on well-conducted farms. When the fodder is fed as a mass of uncut stalks, it is not in a form that can readily be returned to the land. If the stalks are fed in a lot, they usually are left there for sometime to rot, so they will not bother the cultivation too much. By this method, there is a big loss of fertility. If the stalks are fed on the fields, there is considerable trouble with the cultivation the next year, especially if the land is put in a crop like corn, that requires considerable tillage.

The Cost of Shredding

It does not cost much more to shred fodder than it does to handle it in the old way. These figures have been prepared by farmers familiar with the cost under both methods. The crop consists of one thousand bushels that made an average of forty bushels an acre in both cases. This is the cost of handling it by hand:

Cost of husking 1,000 bushels by hand at four cents a bushel.....$40.00

Board for man doing husking, averaging fifty bushels a day, for twenty-one days, at $4.50 a week..... 13.50

Cost of hauling husked corn and fodder from the field, two men and team, five days at $2.00 a day each for the men, and $1.50 for the team..... 27.50

Board for two men for five days, at 75 cents a day 7.50

Board for team for five days at 50 cents a day 2.50

Total cost of getting the corn in crib, and the fodder stacked $91.00

Here is the cost of shredding:

For hire of husker and shredder, including the services of crew, and the use of an engine, 1,000 bushels at 4 cents a bushel, $40.00

Three men pitching in the field, one and a quarter days at $2.00 each a day..... 7.50

Six men to haul stover from the field, one and a quarter days at $2.00 each a day.. 15.00

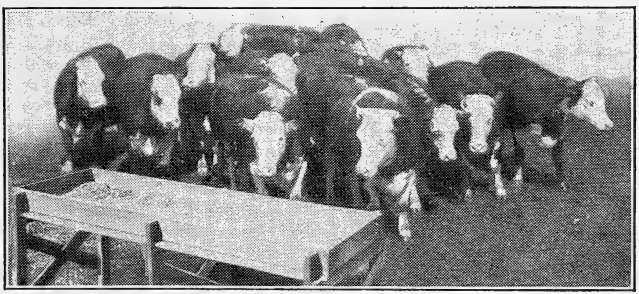
Six teams and wagons for hauling the fodder to the machine, one and a quarter days at $1.50 a day a team..... 11.25

Fuel. 5.62

One man for shoveling corn into crib, one and a quarter days at $2.00 a day.....	2.50
Board for fourteen men, one and a quarter days at 75 cents a day.....	13.13
Feed required for six teams, one and a quarter days at 50 cents a day a team.....	3.75
Total. $98.75	

So $98.75 minus $91 leaves $7.75 as the cost of the shredded fodder. It is quite obvious the shredding is worth far more than that.

What is needed is a more efficient use of the corn crop of the country. There is too great a loss in harvesting the crop at present. It is quite evident that not all the crop can be put in silos, so there is a place, and a big one, for the shredders.



Feeding corn to steers in Illinois.

The main thing is this: With a third of the feeding value of the corn plant in the stalk, it is a business "bonehead" of the worst kind to allow this material to stay in the field, and be harvested by the cattle in the stalk fields. The value of feed can be estimated readily by what the stockmen are willing to pay for it, and it will be found that, in many localities, 50 cents an acre is considered a fair price for stalk fields. Stop this loss.

Shrinkage of Corn

When corn first is gathered in the fall, there usually is quite a rapid shrinkage in weight. This is well known, and accounts for some of the wild scramble among corn growers, to get rid of the crop at that time. This shrinkage is not so great as it usually is supposed. After the corn has passed through the first shrinkage, the rate of loss is largely determined by the moisture and temperature. The bureau of grain standardization tested the shrinkage after this first loss was over, and obtained some interesting results.

The bureau placed 500 bushels of shelled corn, which weighed 28,000 pounds, in the wooden hopper of a 30,000 pound scale in a Baltimore elevator, Jan. 5, 1910. This corn had a moisture content of 18.8, which is a good, average figure. Until

April 21, the corn remained in splendid condition, and the loss was but four-tenths of one per cent. Soon after, the corn went out of condition, and the loss from then on until June 8 was about 7 per cent. That loss probably was much higher than it would have been if there had been a smaller bulk together. The total loss was 1,970 pounds.

The Weight of a Bushel of Corn

Fifty-six pounds of shelled corn constitute a legal bushel in all the states and territories except California, where the legal bushel weighs 52 pounds, and Arizona, where it is 54 pounds. A number of states have no statutory weights. In all such cases, 56 pounds of shelled corn is a bushel. All states that have statutes on the subject make seventy pounds of corn on the cob a bushel, with the three exceptions of Indiana, Ohio and Mississippi, their legal bushels of corn in this form weighing sixty-eight, sixty-eight and seventy-two pounds respectively.

Prevention of the Smut of Corn

The smut of corn is not caused by sowing smutty seed. Seed treatments for disinfecting purposes, therefore, are entirely useless. It is possible to reduce the quantity of smut by going through the fields when it first appears and cutting out and

burning all smut masses. To be at all effective, however, this should be done before the smut boils begin to turn black and break open, because so soon as this happens an enormous number of spores escape into the air, and are widely distributed. This method of combating smut takes much labor, and whether such work gives sufficient returns to be highly recommended has not yet been demonstrated.

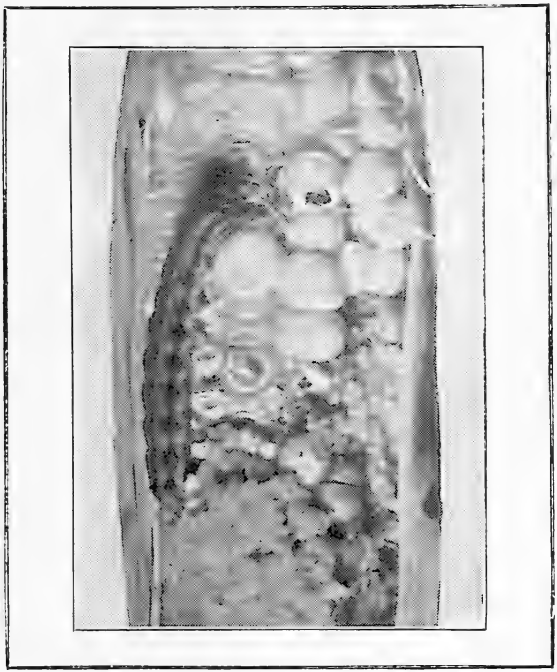
Where much smut from the preceding crop has been brought into the barnyard in fodder and such fodder has been fed to cattle, many live smut spores are to be found in the manure. These not only live over winter on old stalks and in manure, but also may go through the alimentary canal of animals without being injured. In fact, smut will produce its second crop of spores in the manure pile in great abundance.

Some varieties of corn undoubtedly are more resistant to smut than others, but there are so many other factors, such as vigor, yielding power, and the like, which enter into the selection of a variety of corn that little attention has been paid to this phase of the problem.

Insect Enemies of Corn

More than two hundred species of insects are known that feed on corn. Sometimes, in the spring, a farmer is apt to think there is ten times that num-

ber, when he sees the damage. However, while there usually is some damage done to every field, there seldom is a total loss of the crop. Frequently,



The corn ear worm at work.

there is an especially great amount of damage when clover or grass sod is broken up and the land is planted to corn. The insects that have been work-

ing on the legumes or grasses turn their attention to the corn in a way that is quite noticeable.

The best way to combat these insects is by a good rotation of crops, and by fall plowing. If the land is handled properly, if a good rotation is used and if the land is plowed in the fall, there usually will not be much danger from corn insects. The common corn insects are: Cutworms, wireworms, white grubs, root worms, web-worms, root louse, ear-worm and bill bugs. Chinch bugs frequently bother, too, especially when they are produced in a field of small grain, and come to the corn field after the small grain is cut.

How to Judge Corn

Here is a score card that will do for judging dent corn. A study of the card will tend to impress the essential characteristics of a good ear of corn:

1. **Trueness of Type or Breed Characteristics, 10 Points**—The ten ears in a sample should possess similar or like characteristics, and should be true to the variety they represent.

2. **Shape of Ear, 10 Points**—The shape of the ear should conform to the variety type. The ear should be full and strong in central portion, and not taper too rapidly toward the tip.

3. **Purity (a) in Grain, 5 Points**—The color of the grain should be true to variety, and free from

mixture. For one or two mixed grains, cut one-fourth point; for four or more mixed grains, a cut of one-half point should be made. Difference in shade of color must be scored according to variety characteristics. **(b) In Cob, 5 Point**—An ear with white cob in yellow maise or red cob in white maize should be disqualified or marked zero. This mixture reduces the value of the maize for seed purposes, indicates lack of purity, and tends towards a too wide variation in time of maturity, and in the size and shape of the grains.

4. **Vitality of Seed Condition, 10 Points**—Maize should be in good seed condition, being capable of producing a strong, vigorous growth and yield.

5. **Tips, 5 Points**—The form of tip should be regular; grains near the tip should be of regular shape and size. The proportion of tip covered or filled must be considered. Long pointed tips as well as short flattened or double tips are objectionable.

6. **Butts, 5 Points**—The rows of grains should extend in regular order over the butt, leaving a deep depression when the shank is removed. Open and swelled butts, depressed and flat butts, with flattened glazed grains, are objectionable, and must be cut according to the judgment of the scorer.

7. **Grains; (a) Uniformity of, 10 Points; (b) Shape of, 5 Points**—The grains should be uniform in shape and size, making it possible to secure uniformity in dropping with the planter, and consequently a good stand. The grains should also be not only uniform or individual ears, but also uniform in color and true to variety type. The grains should be shaped so their edges touch from tip to crown.

8. **Length of Ear, 10 Points**—The length of ear varies according to variety, type, and the characteristics sought by individual breeders. Uniformity in length is to be sought for in a sample, and a sample having an even length of ears should score higher than one that varies, even if it be within the limits. Set a limit for length of ears of sample according to variety, allowing a variation of one inch. The sum of the excesses and deficiencies in inches should constitute a cut in points.

9. **Circumference of Ear, 5 Points**—The circumference of the ear will vary according to the variety and the latitude. The circumference of the ear should be in symmetry with its length. An ear too great in circumference for its length is generally slow in maturing, and too frequently results in soft maize. Set a limit for circumference of ears of sample according to variety, allowing a variation of one-half inch. The sum of the excesses and deficiencies

in inches should constitute a cut in points. Measure the circumference at one-third the distance from the butt to the tip of the ear.

10. **(a) Furrows Between Rows, 5 Points**—The furrows between the rows of grains should be of sufficient size to permit the maize to dry out readily, but not so large as to lose in proportion of grain to cob. **(b) Space Between Tips of Grain at Cob, 5 Points**—This is objectionable, as it indicates immaturity, weak constitution and poor feeding value.

11. **Proportion of Grain to Cob, 10 Points**—The proportion of grain is determined by weight. Depth of grains, size of cob, maturity furrows and space at cob all affect the proportion. In determining the proportion of grain to cob, weigh and shell every alternate ear. Weigh the grain and subtract from weight of ears, giving weight of grain; divide the weight of grain by the total weight of ears, which will give the percentage of grain. The per cent of grain should be from 86 to 87. For every per cent short of the standard, a cut of one and one-half points should be made.

CHAPTER VII.

WHEAT AS A MONEY CROP

CHAPTER VII.

WHEAT AS A MONEY CROP

Soils for Wheat
The Place of Wheat in the Rotation
Fertilizers for Wheat
Preparation of the Ground
Cultivate the Soil
Use the Disk
Summer Fallowing for Wheat
Local Adaptation
Change in Hardness
Amount of Seed to the Acre
The Enemies of Wheat
Insect Enemies of Wheat
The Hessian Fly
Insects Affecting Stored Wheat
When Should Wheat Be Cut?
Shall We Thresh From the Shock?
Effect of Exposure on Wheat
"Sweat" in Wheat
Heat-Damaged or "Bin-Burnt" Wheat
Stacked Wheat is Easier to Thresh
Relation of Moisture Content to Test Weight
How to Feed Bundles Into the Feeder
In Regard to Selling Wheat
The History of Wheat

CHAPTER VII.

WHEAT AS A MONEY CROP

A carefully prepared seedbed and good seed are the two great essentials for profitable wheat growing. Perhaps the greatest loss is in poorly prepared seedbeds. This is especially true in the principal wheat sections, where this is the main crop. A large acreage of wheat is sown, every year, in Kansas, the greatest wheat producing state, with absolute disregard of proper soil preparation. The average yield of wheat in the United States is less than 14 bushels an acre, which is very near the cost of production.

Soils for Wheat

Many soils splendidly adapted to corn are not good wheat soils. The reason is that wheat is apt to winter-kill on land that heaves much. Clay soil is of this kind; for it usually is markedly affected by thawing and freezing. Quite a bit of the wheat of the country is grown on glacial drift soils, for they are well adapted to growing this crop. However, the preparation of the seedbed has such a marked effect on the crop that a soil not naturally adapted

to growing wheat may produce good crops, if the ground has been properly prepared. On the other hand, the land may be well adapted to growing the plant, and poor seedbed preparation may reduce the yield so much that it is not worth the trouble to harvest it.

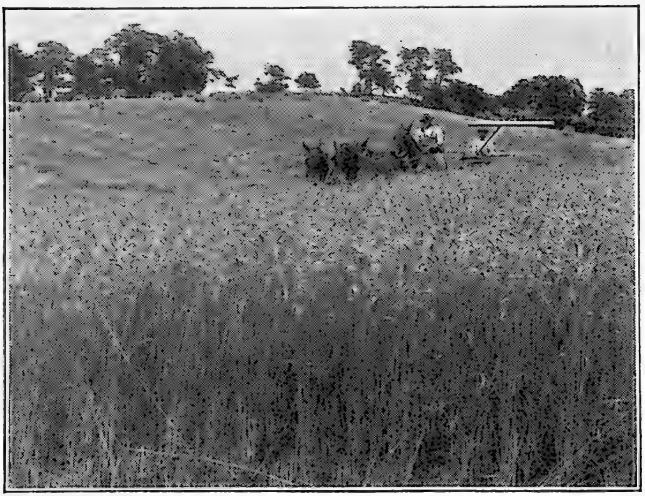
The Place of Wheat in the Rotation

In the corn belt, wheat is of great value as a nurse crop for clover, alfalfa and the grasses. It is especially adapted as a nurse crop for clover. In many sections, it will pay to sow clover in wheat, because a stand usually can be obtained in this way, and it is not necessary to lose a year's rent on a field while one is waiting for the clover to "catch." Probably this accounts for quite a bit of the wheat acreage in corn sections. There should be an extension of the growth of this crop in such states.

But however efficiently wheat is used in rotations in the corn belt, it is certain that corn is not mixed in much with wheat grown in the main wheat belt. There, wheat after wheat is the rotation most used, and in many places there is no effort made to introduce legumes in the rotation. The introduction of a good crop rotation is a much more difficult proposition in the wheat belt than in the corn

belt, mostly on account of the difference in moisture conditions, and partly in the soil conditions.

In most sections of the wheat belt, alfalfa may be grown, and where it cannot, cowpeas often may be introduced in the rotation. But little effort usually



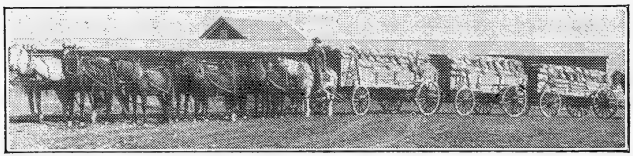
In the wheat fields of Ohio.

is made to keep livestock, and where meat producing animals are kept, the manure is made available for the use of crops much more slowly than it is in corn sections where there is an abundance of

moisture. This much is certain: If farmers in wheat sections do not make an effort to maintain soil fertility, the land will be in a worse condition when it is exhausted than the land in the corn belt, for the moisture and soil conditions will make a reconstructive type of farming harder to introduce.

Fertilizers for Wheat

A large amount of available nitrogen in the land has a bad effect on this crop. An excessive amount of soluble nitrates will cause wheat to lodge, or fall down. This is caused by the forcing of a



Marketing wheat in the Palouse country of the Northwest.

too rapid growth of the stem, which grows so fast it is not able to support itself. If there is too great an amount of nitrogen, the ground should be planted to corn, or some similar crop that can not be injured by too much plant food.

Phosphorus is an element removed by wheat to

a considerable extent, and is most apt to be exhausted by this plant. A proper amount of available phosphorus is essential for wheat to mature profitable crops, and if it is not present in the soil, it should be supplied.

Preparation of the Ground

The seedbed for wheat should be plowed just as soon as possible after the crop that is grown has been harvested. Plowing is still the method most used in breaking the soil, and under most condi-

Soft wheat on a field in southeastern Kansas that yielded 46 bushels an acre. The seed of this wheat came from the Kansas Experiment Station.

tions it is the best way, although listing is all right under some conditions in the West. Ground for wheat should be plowed about five inches deep, or deeper, if it is plowed in July, but the depth of plowing should be decreased as the season advances.

Probably four inches is the best depth for plowing, if the land is not broken until September. This early, deep plowing is important.

Here are the results obtained at the Kansas Experiment Station with the seedbed for wheat prepared in different ways. On these wheat plats, Bearded Fife wheat was sown with a disk drill, at the rate of one and one-fourth bushels an acre. The wheat was sown on all plats the same day, Sept. 29:

METHOD OF PREPARATION.	Yield an acre in bushels	Cost an acre for preparation	Value of crop at 80 cents bushel	Value less cost of preparation
Disked, not plowed.....	4.29	$1.95	$ 3.42	$ 1.47
Plowed September 15, three inches deep	14.46	3.05	11.57	8.52
Plowed September 15, seven inches deep	15.79	3.55	12.63	9.08
Double disked July 15; plowed September 15, seven inches deep.....	23.57	4.35	18.85	14.50
Plowed August 15, seven inches deep. Not worked until Sept. 15..	23.62	3.55	18.89	15.34
Plowed August 15, seven inches deep	27.74	3.90	22.19	18.29
Double disked July 15; plowed August 15, seven inches deep.....	32.68	4.70	26.14	21.44
Plowed July 15, three inches deep	33.46	4.45	26.77	22.32
Listed July 15, five inches deep. Ridges split August 15	34.35	3.75	27.48	23.73
Listed July 15, five inches deep. Worked down..	35.07	3.70	28.05	24.35
Plowed July 15, seven inches deep	38.36	4.95	30.69	25.74

The cost of the various operations was figured as follows:

$1.25 an acre for shallow plowing.
1.75 an acre for deep plowing.
.75 an acre for listing.
.40 an acre for disking.
.35 an acre for Acme harrowing.
.25 an acre for harrowing.
.40 an acre for seeding.

These results stated in another form show the following results:

Land disked but not plowed cost $1.95 an acre for preparation, and produced four and one-half bushels of wheat an acre. The crop, when sold, returned $1.47 an acre over the cost of preparation of the land.

Land plowed three inches deep (too shallow) September 15 (too late for best results) gave a yield of 14½ bushels, and a return of $8.52 an acre after paying for the labor required to prepare the ground.

Land plowed at a proper depth, 7 inches, September 15 (too late) produced 15¾ bushels an acre, and gave a return of $9.08 an acre after deducting the cost of preparation.

Land double disked July 15, to stop the waste of moisture, and plowed seven inches deep Septem-

ber 15 (too late for the best results, even when land has been previously disked) produced 23½ bushels an acre, showing a return of $14.50 an acre after paying for the cost of preparation.

Land plowed August 15, worked sufficient to preserve soil mulch thereafter, yielded 27¾ bushels an acre, with a net value of $18.29 an acre.

Land plowed August 15, seven inches deep, not worked until September 15, showed a yield of 23 2-3 bushels an acre, and a return of $15.34 after deducting the cost of preparation.

Land double disked July 15, to save moisture, plowed August 15, seven inches deep, produced 34 2/3 bushels an acre, and gave a net return of $21.44.

Land plowed July 15, three inches deep, (plowed at the right time but too shallow for the best results) produced 33½ bushels an acre, and a net return of $22.32.

Land listed July 15, five inches deep, ridges split August 15, gave a return of 34 1/3 bushels an acre, and $23.73 over all expenses.

Land listed July 15, five inches deep, worked down level at once, to avoid waste of moisture, gave 35 bushels an acre, from which there was left $24.35 after paying the cost of preparation.

Land plowed July 15 (the right time), seven inches deep, gave a yield of 38 1/3 bushels an acre, the highest yield in the experiment. After paying for the cost of preparation, there was left $25.74 an acre, the largest net return of any method under trial.

These tests show that early, deep plowing for wheat is essential for the highest yields.

Cultivate the Soil

After the soil is plowed, it should be kept cultivated during the summer in order to kill the weeds,

A wheat field in August.
The soil has been well disked, moisture is, being conserved, soluble plant foods are being formed, and the seed-bed will be in splendid shape for the crop later.

conserve moisture, and encourage the formation of available plant food. The ideal seedbed for wheat

consists of firm, well-compacted soil, and to get this firm seedbed from a soil that has been plowed deeply requires time and cultivation. And remember this about the seedbed—if the seedbed is not fairly firm, if the soil has not been well prepared, there will not be good capillary connection of the soil with the subsoil, and if this capillary attraction is not restored, the subsoil water cannot be used by the growing plant. And if the young wheat plants cannot use the soil moisture promptly, they will not make a good growth before the winter sets in. If the wheat does not make a good growth in the fall, the young plants will be injured by the freezing of the ground, for the root system will not get well established.

Use the Disk

Disk the soil every two or three weeks after it is plowed until the seed is sown, if there is a growth of weeds and a firming of the soil by rain so it needs disking that often. Of course, if there is no rain, the soil need not be disked so often. But keep the ground stirred so the surface is kept loose, and evaporation of soil water checked.

Harrow the land well before the seed is planted. And when you plant the seed have this condition in the soil: Have the soil loose about as deep as the

seed is planted, and below the seed the soil should be firm and have a good capillary attraction with the subsoil. The firm soil below supplies moisture for germination and growth, while the mellow soil above the seed allows a good circulation of soil air. It also aids in warming the soil, as it absorbs the heat from the sun during the day, and acts as a blanket over the soil to conserve this heat at night.

Summer Fallowing for Wheat

In general, the practice of fallowing should be discouraged, but there are some sections where it is almost necessary, such as under the conditions in western Kansas and Nebraska. Where the rainfall is not sufficient for the maximum production of wheat, good results have been obtained by summer fallowing, and producing a crop once in two years. At the dry farming station at North Platte, Neb., some extensive work has been done in growing wheat in this manner. Five years' results comparing summer fallowing with continuous cropping is reported from the Nebraska Experiment Station. The following figures are given here because the information is conclusive for the Great Plains area,

with respect to the comparative value of the fallow with continuous cropping:

RELATION OF YIELD OF WINTER WHEAT TO AVAILABLE WATER.

YEAR.	Acre yield	Available water in upper six feet of soil at seeding time.	Precipitation from September 15 to July 1.	Total water available during season.
	Summer Tilled			
	bushels	inches	inches	inches
1907	59.0	.....	13.74	.....
1908	57.0	7.0	13.65	20.65
1908	57.0	8.2	13.65	21.85
1909	37.6	7.0	15.80	22.80
1910	30.2	7.6	10.18	17.68
	Land Continuously Cropped			
1907	24.4	.....	13.74	.....
1908	20.8	1.9	13.65	15.55
1908	29.0	2.2	13.65	15.18
1909	19.0	1.1	15.80	16.90
1910	.....	.....	10.18	.....

In commenting on these results, the writers say "that if the yields on the summer-tilled land for the four years preceding 1910 are divided by two, on account of the land being used two seasons to produce one crop, there will be still three bushels an acre in favor of the summer-tilled land. The summer-tilled land produced six bushels an acre more in two years than that produced on the land not summer-tilled. The seed required to produce two

crops under ordinary methods of tillage is twice as much as that required to produce one crop on summer-tilled land. The labor required to produce the two crops is much more than that required to produce the one crop."

These results do not mean that producing crops once in two years should be the rule where there is a proper amount of rainfall. Not at all. But where the moisture is so reduced that it will not, on an average, produce a good crop every year, growing a crop once in two years often is the most profitable thing to do.

Local Adaptation

The country is divided into hard and soft wheat belts by moisture and soil conditions, and if one is in a hard wheat belt he should grow hard wheat, and if he is in a soft wheat belt he should grow soft wheat. Take, for example, the region around Hutchinson, Kans., which is a good hard wheat country, hard wheat will do better there than soft wheat, and hard wheat should always be planted. But farther east, in eastern Kansas and Missouri, where there is more moisture, the soil is better adapted to growing soft wheat, and soft wheat should be sown.

Durum wheat is coming into favor in some sections. It produces larger crops in many places where

the rainfall is not large than does other wheat. Millers have discriminated against this wheat in the past, largely on account of trouble in grinding it.

The soil was well prepared.

It is excessively hard, and most of the machinery that will handle ordinary wheat will not give good results with Durum wheat.

There is no best variety of wheat for the whole country. Variety adaptations change with the change in communities, and the effort should be to

get seed that will produce the largest yields under your conditions. Always be certain, when you buy new seed, that it is adapted to the conditions such as you have in your section. That is important. And the conditions vary markedly, even in short distances.

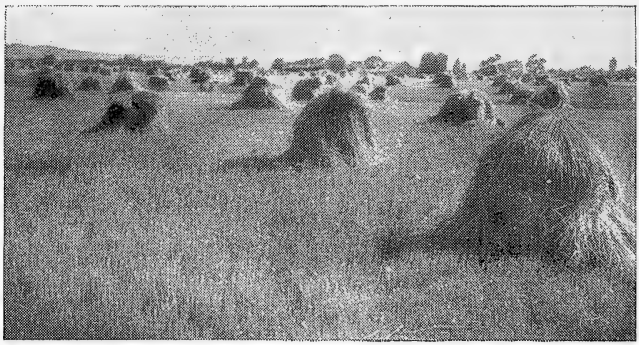
Change in Hardness

The degree of hardness in wheat varies markedly. There are all grades from the soft, starchy grains of the Pacific Coast wheat fields, in the white wheat sections, to the flinty kernels of Durum wheat. And hardness is not a fixed quality with a variety, either. If a seed of hard wheat is taken from the hard wheat section of Kansas, for example, to the southeastern part of the state, it will become softer. And if soft wheat is taken into a hard wheat section, it will tend to become harder. Wheat adapts itself to the moisture and soil conditions under which it is grown.

The varieties of hard wheat are purer than those of soft wheat. Some varieties of hard wheat, Kharkof for example, are practically pure. Make an effort to keep the seed of the variety you grow pure. Be certain there is no mixing when your wheat is threshed. There is more mixing of seed wheat in threshing machines than in any other way. This not only happens with farmers on commercial work,

but it also sometimes happens on experiment stations, when several varieties are being threshed.

One of the best ways to aid in cleaning out the separator, and getting it free from grain the neighbor grew, is to thresh oats or some other crop before you thresh wheat. If you do have to start on wheat, do not save the first few loads for seed; sell



A Kansas wheat field.

them to the elevator. You cannot be sure the machine is free from wheat from the former setting when ten bushels have gone through, or even when 100 have been threshed, although you can be more certain with the higher amount.

After you have obtained the seed and have prepared the land, the next problem is to plant the seed. Wheat always should be drilled. The depth will

vary with the soil. For example, wheat may be sown deeper in a sandy soil than in a clay soil. Perhaps the average depth of planting is about one and one-half inches. The best time for sowing is a complicated problem, on account of the many factors that enter into it. The time depends on climatic conditions and the Hessian fly mostly. The preparation and richness of the land also has something to do with it. If Hessian fly is bad in your locality, you should put the planting off late to escape it. If there is no danger from this fly, planting may be done earlier. There is no best time that can be stated for any locality, because the problem is so complicated, and the best time even will vary from year to year. The most important thing is to escape the Hessian fly.

Amount of Seed to the Acre

In general, too little seed is sown. From five to eight pecks is the proper amount under most conditions. There are few conditions where a seeding of less than five pecks will return maximum yields. But, of course, the exact amount will vary with the year and the variety, for the kernels in the different varieties vary markedly in size.

Always fan wheat before it is sown. Every farmer who sows even a small acreage of wheat can afford to own a fanning mill. Two or more neigh-

bors, however, should go together to purchase the outfit, and divide the cost. Get a power outfit, if you have a gasoline engine to run it, to reduce labor.

Much of the wheat, especially in sections where considerable livestock is kept, is injured by pasturing. There are conditions—where the crop is growing too rapidly during a warm period in the winter is an example—that pasturing may help, but these conditions are not common. So be careful with the pasturing, and do not pasture the crop at all unless the wheat has made a good growth. Do not pasture late in the spring in any case.

The Enemies of Wheat

Cheat is the worst wheat weed. So common is this pest, especially in soft wheat sections, and in such remarkable ways does it appear that it has given rise to the superstition, among some farmers, that wheat can turn to cheat. Of course, this is not true. Wheat will not turn to cheat any more than it will turn to corn. If you plant clean seed on ground free from the weed, and the seed is not scattered on the field in some other way, there will be no cheat in the wheat. Cheat seeds very abundantly, and a single plant has been known to produce more than three thousand seeds. This plant will stand more cold than wheat, and it is not attacked by common wheat insects, but it is not quite so vig-

In the wheat fields of Canada.

orous a grower. These facts explain why wheat will choke out cheat when it grows well, and why, after a hard winter, most of the fields seem to be cheat. The proper way to guard against cheat is always to sow clean seed.

Wheat rust causes quite a bit of damage every year. There is no known remedy. Loose smut is a common disease that causes some loss, but it usually is not bad. The hot water treatment is used for this disease, but this treatment injures the germination power of the seed. Generally it is not necessary to treat the seed for this disease.

Stinking smut, or "bunt," does considerable damage, in some sections. This disease affects the grains, which become considerably enlarged, and filled with a mass of spores. When these spores find their way into flour, they make it unfit for food. Losses from stinking smut frequently run from one-fourth to one-half of the crop, and this practically ruins the grain, of course, for there is no practical way to separate the diseased kernels from the sound ones.

If this disease is present, immerse the wheat intended for seed in cold water, and the smut balls will rise to the surface, and then may be skimmed off. Then immerse the seed for 30 minutes in a solution of formalin, which has been mixed at the

rate of one pound of 40 per cent formalin to 50 gallons of water. This usually will free the seed from smut spores.

Insect Enemies of Wheat

Chinch bugs are one of the worst insect wheat pests. After this insect gets into wheat, there is no practical method that can be used to eradicate it. The growers must take their loss then. The de-

Preparing for wheat in Oregon.

struction of the winter homes of the insect is one of the best methods of combatting chinch bugs. This has been used with considerable benefit by the department of entomology of the Kansas Agricultural College, in Sumner County, Kansas. The department obtained the co-operation of the farmers

there, and all the grass, stalks and other matter where the bugs could find winter quarters were burned, over many square miles. There was a remarkable decrease in the chinch bug damage the next year in that section when compared with surrounding counties.

This burning of vegetable matter to destroy the winter quarters of chinch bugs is something that should be handled carefully, and the method should be used with due regard to the humus supply of the land. Practically all land needs all the humus it can get, and the vegetation should not be burned except where the good resulting from the killing of the bugs will more than pay for the loss of humus. There is no doubt, however, that there are many cases where it will pay.

But there are other methods that can be used with considerable benefit. If the ground is disked soon after a small grain crop is cut, many insects will be destroyed. And as this is just what should be done to prepare the ground for a wheat crop, this method should be used much more extensively than it is now used. Every effort should be made to keep the bugs from going from wheat fields, after wheat has reached maturity and has been cut, to the corn fields. Tar and dust barriers may easily

be constructed, so the bugs may be kept out of the corn, and it pays big to use them.

The Hessian Fly

The adult Hessian fly is a small, almost black two-winged insect which lays its eggs on young wheat in the fall. These eggs produce a larvae which crawls down within the leaf sheaves next to the stem, feeding upon the young plant and finally passing into the pupal stage, which is ordinarily called the flaxseed stage with this insect, because at this stage it resembles a flax seed in general appearance. The insect passes the winter in this stage, and comes out and lays eggs upon the wheat in the spring. These eggs soon hatch, and the larvae produced are responsible for the greatest damage from the Hessian fly. The spring larvae go into the pupal stage, and remain in the wheat stubble, coming out as adults in September to deposit eggs upon the young wheat plants. The principal remedy for the Hessian fly is late sowing. It is often recommended to sow a catch strip around the field early and allow the eggs to be deposited in this wheat, sowing the rest of the wheat later. This catch strip can then be plowed under late in the season, thus destroying the insects. Rotation of crops also will tend to eliminate this pest. In addition to the insects mentioned,

the wheat bulb-worm, wheat midge, and some others cause damage in some sections. But the chinch bugs and Hessian fly are the two principal insects that damage growing wheat.

Insects Affecting Stored Wheat

There are many insects that affect stored wheat; and most of these same insects also bother products that are made from wheat. It is a fight with insects all along the line, from the time the wheat comes up until it is delivered to the ultimate consumers. Fumigation with bisulphide of carbon, which you can purchase at any drug store, is the best remedy for all insects that affect stored wheat, under average farm conditions. In elevators and mills, other remedies are available. Use one pound of carbon bisulphide to every thousand feet of space.

When Should Wheat Be Cut?

In the humid sections of the United States, wheat usually is cut when the straw begins to turn yellow, and when the grains still can be indented between the fingers, but after they have passed well out of the dough stage. There is an increase in the weight of the grain up until it is dead ripe, but the increase is the fastest up until it has reached the stage where it can be crushed, after it has passed out of the dough state. In the dryer sections, where

A well-capped shock of wheat. Wheat will not bleach when it is shocked properly. Note the way the cap bundles are placed.

there is little danger of damage from rain, wheat can be left for many days after it has become dead ripe, with but little damage. This is not true in humid sections, and it is better to cut the wheat a little green than it is to cut it too ripe, because wet weather may seriously damage the crop, and make the land too soft to carry the binders. Therefore, if one has a large wheat acreage, the wheat should be cut promptly.

It always will pay to cap wheat shocks, in humid regions. Shock the bundles in round, medium-sized shocks, and use two cap sheaves. Break the heads and the butts of these sheaves before you place them on the shock, and then smooth them down, just before you leave the shock. This will tend to prevent the bundles blowing off.

Shall We Thresh From the Shock?

Thousands of bushels of wheat are lost, every year, by threshing from the shock, after waiting until the weather has damaged the grain. Never wait on a machine that "will be here the first of next week." Too many things can happen to the threshing rig, and there is too great a danger of loss from rain to make it profitable to afford to wait, is an axiom to be followed year after year. Always stack the grain when it is ready. There is not much

loss of time, anyway, by doing this even if the machine comes just as you finish stacking, when you consider the "deadhead" time of the men and teams while waiting when the machine is moving and when it breaks down.

On the contrary, there may be a loss of most of the crop, if it is allowed to stand until a machine finally comes. The author has seen wheat that

There is no hurry to get the threshing machine now.

was cut in June and allowed to stand until the middle of August, with the promise the machine would come soon. There are many cases like that every year.

Effect of Exposure on Wheat

L. A. Fitz, professor of milling industry in the Kansas Agricultural College, said, in speaking of

the damage to wheat in the shock: "In addition to causing the bleached appearance and lowering the test weight, the exposure of wheat to rain and sun while standing in the shock causes many of the kernels to sprout, and sprouted wheat will not produce good, sound flour. Furthermore, the indications are that this excess moisture acquired in the field after harvest continues to be a source of injury to the quality until the wheat is dried either artificially or by natural means.

"Sweat" in Wheat

"Millers, as well as operators of country and terminal elevators, prefer wheat that has gone through the 'sweat.' The millers invariably hold that sweating in the stack improves weathered grain, and is much to be desired. Comparatively little is known as to what the process commonly referred to as 'sweat of wheat' consists of. It is known that even after wheat is cut, the straw contains sufficient plant food to keep the kernels in a growing condition for some time, and a chemical or enzymic action within the plant by means of which this nutriment is transferred to the grain and stored as starch may continue for a considerable period. When wheat has been threshed before going through the sweat, it is probable that a rear-

rangement of the chemical constituents of the kernels still takes place, and this will account for the sweating of shock-threshed grain in the bin.

"As chemical action is generally accompanied by the evolution of heat, this may account for the heat usually generated during the sweating process. The amount of heat generated appears to be influenced by the percentage of moisture present. Grain that has been sufficiently ripened and is also very dry will give little evidence through change in temperature that it is going through the sweating process. On the other hand, wheat cut in the hard-dough stage, or containing considerable moisture, goes into the sweat much more quickly when stacked; the straw becomes very tough and a great deal of heat is evolved. Care should be exercised not to stack wheat of this character before it is allowed to cure out in the shock for a few days; otherwise sufficient heat may be evolved, even in the stack, to injure the grain, in which case 'stack-burnt' wheat will result.

"Cutting the grain seems to act as a sort of check upon this biological action, and it appears to remain in a dormant state until the assembling of the grain in large bulk brings on a condition favorable to activity. When the grain is stacked, the straw permits to a limited extent the circulation of

air through the stack, and this circulation affords a means of conducting away considerable of the heat generated in stacked grain.

Heat-Damaged or "Bin-Burnt" Wheat

"If wheat with a rather high moisture content is placed, before going through the sweat, in a large bulk in a bin where there is very little chance for a circulation of air, and any heat generated by biological action is retained in the grain until finally the temperature becomes so high as to cause other

High-yielding wheat in Colorado.

chemical changes within the kernels, the result is what is commonly known to the grain trade as heat-damaged or 'bin-burnt' wheat. This injury may extend simply into the branny coats and produce slightly heat-damaged or 'bran-burnt' wheat, or it

may extend throughout the endosperm and produce badly heat-damaged or 'bin-burnt' kernels. Wheat in this last condition is practically unfit for flour-making purposes.

"There is little evidence as to whether this change or sweat which takes place in the bin is identical with that which takes place in the stack. It at least appears to have much the same effect on the milling and baking qualities, provided the wheat is not allowed to heat enough to become injured or 'bin-burnt.'

Stacked Wheat is Easier to Thresh

"If the farmer who properly stacks his wheat secures it against further loss from exposure to weather, while the one who allows his grain to stand in the shock from three to six weeks, waiting for the thresher, runs the risk of having it deteriorate from No. 1 or No. 2 to No. 4 or even to 'no grade.'

"Another gain which may result from properly stacking wheat is that it will come out of the stack dry and thresh out clean from chaff, thus preventing the loss sustained when threshing bundles that are damp and tough from rain or dew. With the bundles in this damp condition, considerable wheat remains in the heads or is blown over as 'whitecaps,'

and goes to the straw pile. This is usually a total loss, as much of the straw in the Great Plains area is burned.

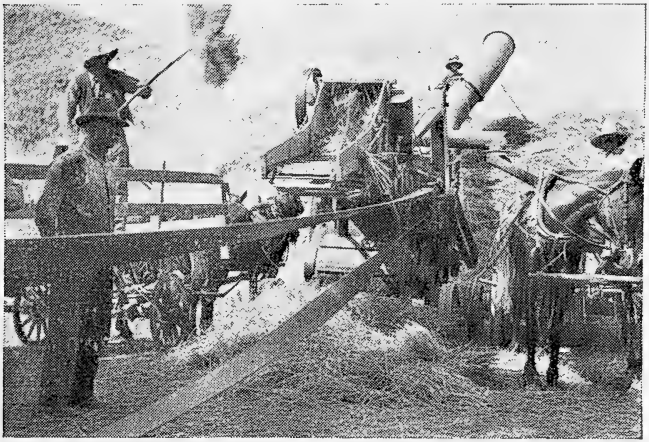
"Improvement in the quality and condition of the wheat is not the only benefit derived from stacking the crop. In addition to making the crop safe should several heavy rains come after harvest, which would prevent threshing and cause rapid deterioration, the stack-threshed grain can be placed in tight bins and kept, or it can be shipped direct to market without imminent danger of heating and spoiling in transit. Also, the shocks are removed from the field, so that plowing may be begun at once, and all good farmers readily agree that such early plowing is productive of good results in the next year's crop."

Relation of Moisture Content to Test Weight

There is a close relation to the rate of increase in the moisture content and the decrease in the test weight. This relation is not constant, but it is enough so that it can be counted on. And more than this: If there has been an increase in the moisture content, with a corresponding decrease in the test weight, a complete reverse action is not possible. Therefore, if the grain has been damaged by exposure or by being stored under improper condi-

tions, it never will be so good as it was. The moral of this is obvious: Handle the grain properly if you desire the best price.

But when the wheat is threshed, no matter whether from the shock or the stack, be certain of the men you have doing the pitching. Many thousands of bushels of grain go through threshing ma-



Threshing in Kansas.

chines and on the strawpiles every year because of "bonehead" pitching into the machine. No make of separator can do good work if the pitchers are slugging it all the time. For one thing, the separator man can not keep the concaves screwed up

tight, for if he did, he would have to buy cylinder teeth by the thousand. All he can do, when he strikes an especially rotten bunch of pitchers, is to let the concaves down, in order to keep his machine going at all. As a result, the grain is not knocked out of the heads. Then, even if it is knocked out of the heads, no machine can do a good job of separation if the grain is coming in bunches.

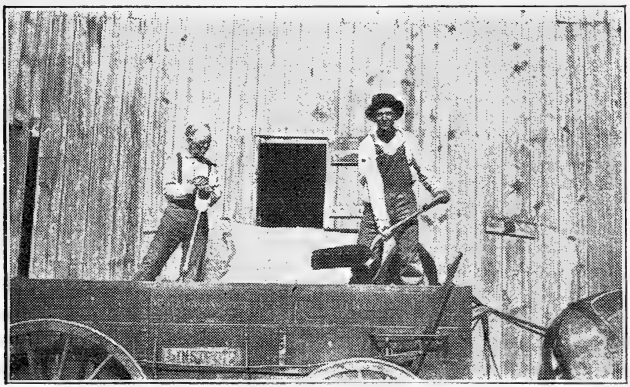
How to Feed Bundles Into the Feeder

Feed the bundles into the feeder in two rows, with the heads of a bundle on one side even with the band on a bundle on the opposite side. Always feed the bundles in heads first, to allow the cylinder a better chance to knock the grain out of the heads, as the bundles go through. If the bundles are fed into the machine in this way, in a steady, uniform manner, the separator man can put the concaves up tight, and the machine will have a chance to knock out the grain. Finally, always get men to do the pitching that you can depend on. For example, it is easy for pitchers who understand the proposition to choke up a machine, if they wish to, especially if the bundles are a little damp. Many of the stops with some machines are caused in just this way, and in others the machine is choked down as a result of just plain ignorance on the part of the pitchers.

Feed the grain into the machine properly, and give the separator a chance. If this is done, there will not be nearly so many green strawstacks on the farms in the fall.

In Regard to Selling Wheat

Market manipulation of prices has been reduced to a science, and an effort always is made by speculators, who never have grown a bushel of wheat and do not intend to, to make a living from profits that should go to the growers. And they do, too,



The man who has a bin is not affected by market manipulation at harvest time.

aided by this almost criminal lack of business judgment which leads men to "dump" their wheat as soon as it is grown. There is not the slightest use

of all this mad scramble to sell the wheat crop every year, for the growers who hold their wheat make money by doing so. But you advance the old, time-frazzled explanation and excuse that "the farmers need the money?" Well, what of it? To begin with, not more than 25 per cent of the bell flock who "dump" their wheat really need the money, and those who do easily can borrow it with the wheat as security. Wheat is good security.

What is needed is more wheat bins on the farms. The grain then can be stored until the growers are ready to sell, and the roads are in good condition. When a grower has storage space for the grain he produces, he is much more independent than if he did not have this space. Good wheat bins are not expensive.

The History of Wheat

Wheat was cultivated in Egypt at least 5260 years ago. At least some grains of the bread plant were found in a brick taken from the pyramid of Dasher, built in 3359 B. C. Many of the writings on the oldest monuments of that country tell of the growing of wheat. The Egyptians called it "br." It was smaller grained than modern wheat. There are many accounts of wheat grain taken from mummies, and these grains have been planted, but they never have germinated.

The Chinese also cultivated wheat many years ago. In 2700 B. C. they instituted an annual ceremony, in which the emperor and the princes took part, in the sowing of five kinds of seed, and wheat was one of the grains. Lake-dwellers in ancient Switzerland grew wheat, and they called it "Triti-

The start of the trip to the "ultimate consumer."

cum vulgare compactum muticum," which was about all the ancients could manage. Just where wheat first originated is an unsettled question, but most of the evidence points to the Euphrates valley, which was the original home of man. From there it has spread over the world, and is the most important bread crop, today.

CHAPTER VIII.

OATS ON CORNBELT FARMS

CHAPTER VIII.

OATS ON CORNBELT FARMS

Place of Oats in the Rotation
The Preparation of the Seedbed
Oats for Semi-Arid Conditions
Cleaning and Grading the Seed
Rate of Seeding
Oats Should Be Drilled
When to Harvest
Enemies of Oats
Formalin Treatment for Smut
Marketing Oats
Preparation for Market
Feeding Value of Oats
Oats for Dairy Cows
Utilization of Oats Straw
Oats Crop of the World

CHAPTER VIII.

OATS ON CORNBELT FARMS

Oats is the best horse feed. Its value for colts is especially great, and animals fed a liberal grain ration always have a better coat, and will stand work better than those that do not get oats. For these reasons, there should be an extension of the acreage of oats in the corn belt.

The commercial oats of the country should be produced in sections especially adapted to their growth. At the prevailing prices, farmers in the corn belt can not make so much profit from oats if they are sold on the market as they can from other crops, because if the oats are sold into the markets of the world they have to compete with the crops raised in sections where the moisture and soil conditions are especially favorable for oats production. So as a commercial grain, oats should be grown in sections where high yields of heavy oats is the rule, and the growing of this crop in other sections should be for furnishing feed for animals. And for this purpose it should be considered one of the essential crops of corn belt farms.

Place of Oats in the Rotation

Oats is especially adapted to growing between corn and wheat in the rotation. In arranging the rotation, remember this: If there are any natural barriers on your land to the spread of chinch bugs, such as creeks, get them between the wheat fields and the oats fields if possible, for this crop usually ripens after wheat, and many times chinch bugs

Threshing oats in Montana.

will move from the wheat after it has been cut, and do serious damage to the oats. As a nurse crop for clover and other legumes and grasses, oats is not so good as wheat. It is, however, used for this purpose some, notably in Illinois. Wheat ripens so it allows the grass or legume crop to become somewhat used to the sun before the wheat is cut, and oats does not do this to so great an extent.

Oats is somewhat similar to wheat in habit of

growth. The culms, or stalks, are larger, and the tissue is softer. The height of the plant varies markedly with the fertility of the soil. The legal weight of a bushel of oats in the United States is 32 pounds, except in Idaho, where it is 36; Maine, Virginia and New Jersey, where it is 30, and in Maryland where it is 26. The legal weight in Canada is 34 pounds. The weight varies all the way from about 24 pounds to twice that, and usually will vary in every locality every year, except in some regions especially adapted to growing oats.

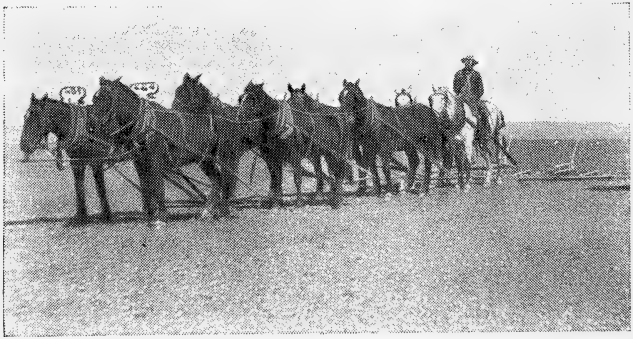
The Preparation of the Seedbed

Do not sow oats on land that has an excessively large amount of nitrogen present, or the crop will lodge, or fall down. This is an important point, for there is considerable loss every year in just this way. Take, for example, in fields along the creeks of the Middle West: Oats usually will grow well enough there on the main part of a field, but there usually is land along the creek banks where the supply of available nitrogen is too great, and the crop falls down. Where this is the case, such land should be planted to corn for which it is especially adapted.

The type of soil, if the land is not too rich, is of less importance with oats than with other crops. This crop does best on loam or clay soils, largely on account of the superior water-holding capacity of

these soils. Oats require considerable moisture, but that does not mean they should be planted on excessively wet land.

Plow the land for oats in the fall, if possible. While plowing the land in the spring is a common, it does not produce yields nearly so large as fall plowed land. This is because there is not time for the soil to become compact, and in good condition for the crop. Oats do best in a rather firm seedbed, with an inch or two of mellow soil to top.



Seedbed preparation on a big scale in the West.

This mellow soil allows the air to get to the seeds, it absorbs the heat of the sun readily, and is favorable for the germination of the plants.

Frequently, where the preparation of the seedbed is delayed until spring, it is possible to prepare a fair

seedbed by disking. The seedbed does not have to be deep, as this is one of the most shallow-rooted crops. Do a thorough job of disking; sometimes a double-disking is enough, but frequently more cultivation will pay well.

Oats Seed

At the Kansas station, the leading varieties of oats are: Red Texas, which has yielded an average of fifty-one bushels an acre; Sixty-day, forty-five bushels; Kherson, forty-four bushels, and Burt, forty-one. The seed should be drilled in the spring about as early as the ground can be worked. There are winter varieties of oats that are a success in the South, but their value in the middle northern states remains to be demonstrated yet, when they are compared with spring varieties.

Oats for Semi-Arid Conditions

There are a number of spring varieties of oats that withstand drought to a marked degree. Among the most promising are Sixty-Day, Kherson, Burt, and Swedish Select. These varieties are usually quick growers; hence they are able to use to the best advantage the early spring moisture and by maturing early escape to a considerable extent the severe droughts which occur later in the season. The best basis for recommendations as to varieties for any

given section is furnished by the variety trials conducted by the agricultural experiment stations, but these can not always be taken as a guide, as varieties which do well on the type of soil represented by the station may not succeed on some other type of soil in the same state.

Cleaning and Grading the Seed

Seed oats should be carefully screened and graded before sowing. This work is ordinarily done with the fanning mill, the light oats and some of the trash being taken out by a current of air, while the small oats and most of the weed seeds are removed by screens. The process should take out one-third or one-fourth of the oats, but if the seed is light, a much larger proportion should be removed by the fans. Many of the small, light oats will not germinate at all, while others produce weak plants, which materially reduce the yield. Screening also greatly reduces the proportion of weed seed, thus preventing the spread of weeds and further favoring the growth of the oats crop.

Experimental tests of graded seed naturally fall into two classes, one in which the same weight or measure of all the different grades of seed is sown, and one in which the same number of seeds is sown on the different plats. Most of the tests belong to

the first class, in which the same rate of seeding by weight is used for all grades. In a test of this kind which was conducted for eight years at the Kansas station, heavy seed gave an average yield of

The last load.

30.9 bushels to the acre, common seed 29.9 bushels, and light seed 27.5 bushels. The common seed used was the seed as it came from the thresher, the light and heavy grades being obtained by running the seed through a fanning mill. These grades were

usually taken from the ordinary seed, but in the last year of the experiment, when the greatest difference was noted, the heavy seed was taken from the heavy grade of the previous year and the light seed from the light grade. In an experiment conducted at the Ohio station for seven years average yields of 46.3, 44.8, and 42.6 bushels were obtained from the heavy, common, and light seed. The yield of straw and the weight were both slightly heavier from the heavy seed than from either of the other grades.

At the Ontario, Canada, Experimental Farm even more marked results in favor of large seed were secured, using the same number of grains of each grade to the acre. In a seven-year test average yields of 62, 54.1 and 46.6 bushels to the acre were obtained from heavy, medium and light seeds, respectively. In a test in which the heavy seed was selected from the heavy grade and the light seed from the light grade of the previous year, the difference in yield and in weight in favor of the heavy seed continually increased. The test was conducted for twelve years. The difference in weight in favor of the heavy seed in the first four-year period was 3.2 pounds to the bushel, in the second period six pounds, and in the third period 9.5 pounds. The differences in yield an acre were 10.4, 15.8, and 22.4 bushels, respectively, for the three periods.

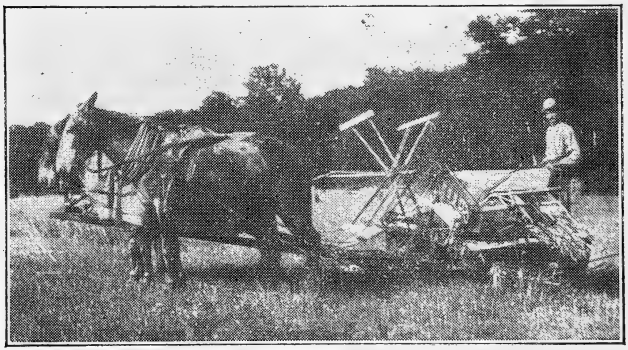
Rate of Seeding

The rate of seeding depends on the locality, the condition and fertility of the soil, the method of seeding and the size of the seed. As with other crops, less seed is required in dry than in humid sections. Fertile soils require less seed than poor ones, as on rich land the plants grow larger and tiller more. More seed should be sown on weedy land or on land not well prepared than on clean, mellow soil. Drilling requires less seed than sowing broadcast. More bushels of large-grained than of small-grained oats should be sown on an acre. The number of grains in a measured bushel of oats ranges from 500,000 to 750,000, according to the variety. The large-grained varieties usually grow ranker, and the plants occupy more space than the small-grained ones, but the difference in the size of the plants does not equalize the difference in thickness of stand caused by the greater number of plants produced by a bushel of small-grained oats.

In general, the rate of seeding in the upper Mississippi Valley ranges from eight to twelve pecks to the acre, but in the drier sections of the West this rate is reduced by half. In the irrigated sections six to eight pecks is the common rate. Where the usual rate in broadcast seeding is twelve pecks, ten pecks will be sufficient if the seed is drilled.

Oats Should Be Drilled

The seed cannot be put in with a drill if the ground is not well prepared. From one to two inches is the best depth for planting. The depth of planting does not affect the yield much, even if it is deeper than the figures mentioned, but there no reason for putting the seed down in the ground



Between acts in the drama of harvest.

where much of the stored energy must be used in getting to the surface. The drilling of the seed is more important than it usually is supposed to be among farmers. The Kansas station has found there is a difference of from three to four bushels, on an average, in the yields of oats sown with a drill and those sown broadcast.

When to Harvest

Through much of the West, rust is one of the worst oats diseases, and causes serious loss. The main thing to do to prevent this disease is to grow varieties that are as nearly rust-proof as possible. The Red Texas variety is fairly rust-proof in Missouri. When rust gets in oats bad, about the best thing one can do is to cut them at once. The rust weakens the plant materially, so if there is a wet

Place oats bundles in long shocks.

period, the plants usually will fall down, and the crop then will be lost. But if the rust does not get in the crop, it should be cut in the hard dough stage. Frequently, the crop is cut in the milk stage, and the resulting hay is used without threshing. This

produces a feed that has considerable value, and is a method especially good where there is some difficulty in getting the crop threshed.

Shock the oats in long shocks, with two bundles opposite each other. Proper shocking is important, and is harder to learn than proper shocking for wheat. The stems, on account of their soft structure and high percentage of water, are hard to cure, and frequently much loss occurs on account of stacking before they have cured properly. Setting the bundles up properly is an art too few farmers have learned. The bundles must be set so the heads fit in properly, but not so they lean so much that they are apt to twist out of shape.

The same principles will apply to threshing this crop as apply to wheat, and the same special care should be given to pitching the bundles into the feeder. Few separators get the grain out of the straw that they would get, if the bundles were fed into the machine properly.

Enemies of Oats

Weeds frequently damage this crop, for, like all spring-planted grains, weeds have a good chance to grow, especially if the crop starts slowly. Wild mustard is one of the principal weed enemies, and it may be eradicated by spraying at the rate of fifty

gallons to the acre with a three per cent solution of copper sulphate.

There is no remedy for rust except the one that has been given; which is to get a variety as nearly rust-proof as possible. Not so, however, with smut. Smut in oats easily may be controlled by treating with a formalin solution. At the Illinois Experiment Station experiments have been carried on with treated and untreated seed for many years, and but 44 per cent of the treated plats ever showed any loss at all, and the damage, in every case, was slight. On the untreated plats grown under the same conditions, the damage has been from one-fourth of a bushel to thirteen bushels of grain, and a lowered quality every year. Therefore it is quite evident that it will pay well, when considered on the law of the average, to treat oats seed.

Formalin Treatment for Smut

To make the solution, use one pound of forty per cent formalin to forty gallons of water. Mix well by stirring. Spread a layer of oats on a tight floor or in a wagon box to a depth of about four inches. Sprinkle the top of the pile with the solution, stir the oats, and repeat the process until all the grain is dampened thoroughly. When the grains are dampened properly, shovel the grain into a pile, and cover

with an old blanket or a canvas. Leave the pile covered for twelve hours, and then sow.

Chinch bugs and grasshoppers are the worst insects that attack this plant. One should be especially careful in regard to chinch bugs. These will go from wheat fields to the oats fields when the wheat is cut, and they may seriously damage an oats crop after the wheat has been injured. Tar or dust lines should be constructed to keep them out.

Marketing Oats

The greater portion of the oats crop of the United States is fed on the farms where it is grown. According to the figures of the bureau of statistics of the U. S. Department of Agriculture, in the ten years from 1900 to 1909, 28.7 per cent of the crop was shipped out of the county where it was grown. The average annual shipment for the ten years was 246,000,000 bushels. The smallest proporton of the crop shipped out of the county where grown was of the small crop of 1901, 19.5 per cent, and the largest proportion was of the crop of 1909, the largest crop on record, 32.7 per cent. The largest shipment of any one crop was of that of 1909, nearly 330,000,000 bushels.

Preparation for Market

The grade of oats can often be raised by running the grain through a fanning mill, removing the dirt,

trash, weed seeds and light oats. Little attention is paid to the matter of dirt in market oats, however, either at country elevators or at the central markets, so that at present the farmer is hardly justified in cleaning his grain before marketing. Oats are occasionally clipped to increase the weight and the

The old way.

market price. By this process, a portion of the hull is removed from the tip of the grain, but as special machinery is required it is little used except in elevators. Bleaching with sulphur fumes or other chemical means is sometimes used in elevators to improve the appearance of oats. By this process grain which has been discolored from weathering or

from heating in stack or bin is rendered bright and white in appearance. While it is probable that the bleaching process causes little damage to the feeding value of the grain, its germination is often materially lowered, and bleached or purified grain should never be bought for seed without a satisfactory germination test. As weathering or heating usually diminishes the feeding value of grain, chemically purified grain is ordinarily somewhat lower in that respect than its appearance indicates.

Feeding Value of Oats

Both oats straw and grain have a high feeding value, if they are handled properly.

DIGESTIBLE NUTRIENTS IN OATS, OAT STRAW, AND OAT HAY, AS COMPARED WITH OTHER GRAINS AND GRAIN PRODUCTS.

MATERIAL.	Dry matter in 100 pounds	Digestible nutrients in 100 pounds.		
		Protein.	Carbohydrates	Fat.
Grain:	lbs.	lbs.	lbs.	lbs.
Oats	89.0	9.2	47.3	4.2
Wheat	89.5	10.2	69.2	1.7
Barley	89.1	8.7	65.6	1.6
Corn	89.1	7.9	66.7	4.3
Roughage:				
Oat Straw	90.8	1.2	38.6	.8
Wheat straw	90.4	.4	36.3	.4
Barley straw	85.8	.7	41.2	.6
Rye straw	92.9	.6	40.6	.4
Corn stover	59.5	1.7	32.4	.7
Hay:				
Oat Hay	91.1	4.3	46.4	1.5
Timothy hay	86.8	2.8	43.4	1.4

Oats are higher in protein than corn and about equal to wheat and barley. They are higher in ash than any of the other grains, and considerably higher in fat than either barley or wheat. On account of the hulls, oats contain the highest percentage of crude fiber, an undesirable element. Oat straw contains more protein and more fat than corn stover or the straw of any other small grain, according to C. W. Warburton of the U. S. Department of Agriculture.

By far the larger part of the oats crop is fed to horses. It usually is fed whole. In the feeding of young colts and older animals with poor teeth, grinding or crushing the grain is of benefit. Musty grain should never be fed to stock. New oats should be fed with caution, as they are likely to have a decidedly loosening effect on the bowels. When oats are high in price, corn or other grains can be substituted in part in the ration for horses.

Oats for Dairy Cows

The high protein content and readily digestible nature of oats make them an excellent feed for dairy cows. Often, however, they are too high in price to feed with profit. According to a test conducted by the Wisconsin station, oats, pound for pound, are somewhat more valuable than bran for milk production. On this basis, with bran at $25 a ton, oats are worth forty-four cents a bushel for dairy cows. The

grain is usually fed whole, though it is sometimes crushed or ground or fed in the form of corn and oat feeds. Some of the prepared feeds bearing this name, however, contain a large percentage of oat hulls and little of the grain. Oats are excellent for feeding to calves, particularly to those of the dairy breeds. They seldom form an important part of the ration of fattening cattle.

Oats are valuable for feeding to sheep, particularly to growing lambs and to ewes. While experiments show that this grain is only a little lower in feeding value than corn for fattening sheep, better results will be obtained by feeding corn and oats mixed than oats alone. Oats are usually fed unground. Breeding ewes should be fed a half pound of oats, bran, or peas daily, the selection of the grain depending on the availability and the relative prices of the different feeds. Sheaf oats make good feed for sheep as well as for other stock. Ground oats can be fed to young lambs with excellent results.

Utilization of Oats Straw

Oat straw is quite largely used for feeding to horses, cattle, and sheep. As a part of a maintenance ration, it is of considerable value, being nearly equal to corn stover (the stalks with the ears removed). If the straw is of good quality there will

be less waste in feeding than with stover. It is higher in feeding value and more palatable than the straw from any other small grain. A common practice in feeding oats straw is to allow the animals to run to the stack at will. This is wasteful when

Stack oats straw carefully, and save all the feed possible.

roughage is high in price, as much of the straw will be trampled under foot and worked into the manure. A better plan is to feed the straw from mangers or open racks, as there is much less waste from feeding in this way.

Oats Crop of the World

The oats crop of the world is nearly 3,700,000,000 bushels annually, most of which is produced in

Europe and North America. The principal oats-producing countries are the United States, European Russia, Germany, France, and Canada. In the United States the greater portion of the crop is grown in the upper Mississippi Valley. Illinois, Iowa, Wisconsin, Minnesota, and Nebraska are the leading states in the production of oats. The annual crop of the United States is about 900,000,000 bushels.

CHAPTER IX.

THE SORGHUMS

CHAPTER IX.

THE SORGHUMS

Soils for Kafir
In Regard to the Seed
When You Thresh Kafir
Kafir as a Feed
In Growing Milo
Distribution of Milo
Rate of Planting Milo

CHAPTER IX.

THE SORGHUMS

Kafir, which now is the commonly accepted name of this crop instead of kafir corn, is a plant of comparatively recent introduction. In plant food requirements and feeding value it is somewhat similar to corn, but it will produce larger crops on poorer soils and with less moisture. That has made it a crop especially adapted to semi-arid conditions, and to thin upland soils that will not produce a large yield of corn. During a drought, the leaves curl up and the plant will stand almost dormant until more moisture comes, and it then will grow almost as well as before. This is an important property corn does not possess. The leaves have the power of closing the openings tighter, so the plant tissues are not so much injured by hot winds.

Kansas is the banner kafir state, with about two million acres, and Butler county is the principal kafir county in that state, with an acreage of almost a hundred thousand acres. Kafir is the principal crop of that section, and at Eldorado, in that county

a kafir festival, or fair, is held every fall that is the most complete thing of its kind in the world. Kafir

A field of high-class kafir. Note that the heads are uniform; the seed is pure.

was introduced into the United States about twenty-five years ago.

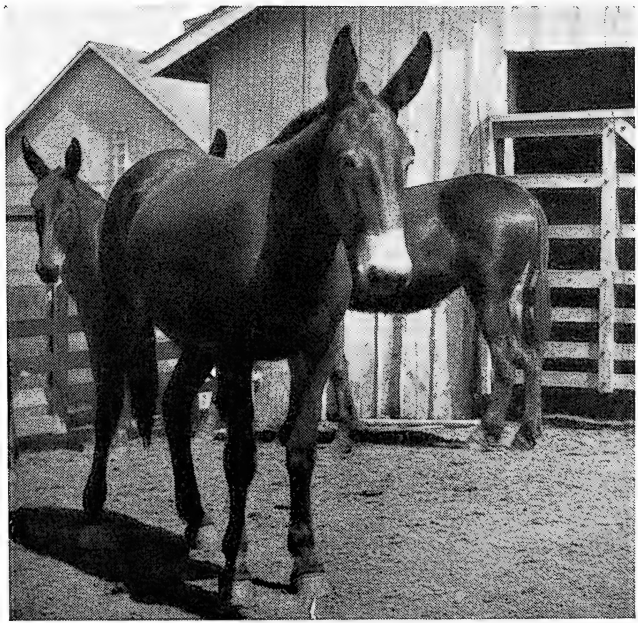
Soils for Kafir

Kafir will grow on almost all soils, but it will do the best, of course, on deep, fertile loams. It will do well, however, even on thin upland soils, for it is able to make a better utilization of available plant food than is corn. It does not get more plant food and moisture by making a deeper growth, for on the contrary, this is a shallow-rooted crop, more so than corn. The roots are all in the first three feet, and most of them in the first eighteen inches of soil. It is drought resistant because of the remarkable development of fibrous roots in the top soil. This enables the plant to get about all the moisture in the land.

But kafir is not especially "hard" on land. It is no more so than corn. It is true that a crop like corn that is planted early in the spring does not do well after kafir, and the reason is this: Kafir grows late in the fall, and exhausts the land of moisture and available plant food, and as the winter comes soon and stops the development of soluble nitrates, there is a deficiency in the soil the next spring. The soluble nitrates will not develop until warm weather comes the following spring, and the land will break up cloddy so long as there is not a sufficient amount of moisture. Thus, early the next spring the land is in poor physical condition, and is lacking in avail-

able plant food. The thing to do is to put this land in a crop like cowpeas that is planted late in the spring, after there has been time for a formation of soluble nitrates.

Ground should be plowed deeply for kafir, and the seedbed should be as well prepared as for corn. Indeed, the killing of all weeds just before the seed is planted is even more important than for corn, for



"Friends, Romans, countrymen."

the plants make a much slower start. Frequently, the ground is planted in the fall and winter, and this is a good practice, for it gives the soil time to weather, and there is a much better development of plant food than if the plowing was done just before the seed is planted.

Do not be in a hurry to plant the seed. Kafir will not make a good growth until the soil is well warmed; it is hard on the plants to be planted until the soil is thoroughly warmed, and if they are planted too soon the seed will rot in the ground. The plants will make a slow growth the first few weeks, anyway, and the weeds will get a good chance to cause trouble under the best conditions.

In Regard to the Seed

Plant pure seed. The average kafir field usually consists of a mixture of three types of kafir seed and some cane thrown in for variety. The yields in these fields are not so great as they would be if good seed was used. It is easy to get pure seed, and if you keep out the mixtures, such as those one gets in a threshing machine, it will stay pure. Smut damages some of the kafir of the country every year, and to be on the safe side, the seed always should be treated. This is the way to do it: Heat the seed for fifteen minutes in water at a temperature of from

132 to 134 degrees F., and the smut spores will be killed, while the seed will not be injured. Do not heat the seed higher than this, but it should be raised to that temperature or the smut spores may not be killed. Plant from six to eight pounds of seed an acre for both seed and forage.

Cultivate kafir the same as corn. In the first few weeks of their life, the plants make a slow growth, and there is danger that grass and weeds may take the field. This is especially true if the

Preparing for kafir.

weather is damp, for the cultivators will thus be kept out of the field, and conditons will be good for a rapid growth of grass. Keep the cultivators going

all you can, and begin just as soon as you can after the plants come up.

It requires from 110 to 135 days to properly mature kafir. If the crop is planted late in the spring, this means it will not be ready to harvest until late in the fall. Much of the crop is cut with a corn binder, and that is one of the best ways to harvest it. If the binder is used, make small bundles, and shock them in small shocks; from twelve to fifteen bundles to the shock is enough.

Most of the crop is headed in the fields with a wagon box header, and the stalks then may be cut with a binder. After the seed is cut, it should be stored in covered sheds, so it will be protected from rain. Slat corn-cribs that are not wider than five feet and are covered are good places to store the seed until it is threshed. There should be no danger of heating with the seed stored in this way. Most of this complant every year about the heating of seed is caused by the seed being stored in too large quantities, or where it will not dry out.

When You Thresh Kafir

Kafir seed should be threshed without cracking it. Here is an important point about the threshing: Loosen up the machine and take out some of the concaves. If you do not do this, the seed will be cracked badly. Then clean the grain at once, and

remove all of the dirt and kafir flour that is in the seed, for this will cause heating if you do not. Kafir will ferment when it is heated. Well-cleaned seed will allow the air to circulate freely, and there will be no danger of heating.

Kafir as a Feed

Kafir will compare well with corn, so far as the feeding value is concerned. The following table shows the relative value of the two grains:

	Protein	Carbo-hydrates	Fat
Indian corn	7.8	66.7	1.6
Kafir corn	7.8	57.1	2.7

From this it will be seen that kafir corn can take the place of Indian corn as a feed. For comparison in digestibility reference should be made to the table above and to the following one that gives the percentage of digestibility of kafir corn nutrients:

	Dry Matter	Protein	Carbo-hydrates	Fat
Kafir corn seed	53	46	60	46
Kafir corn fodder	61	38	66	61
Kafir corn stover	57	34	60	75

Much of the crop may be fed without heading or threshing, and cattle and horses do well on this sort of feed, after they have time to get used to it. The grain should be fed separately to fattening animals. The grain is not quite so easy for the animals to

digest as corn. Kafir is splendidly adapted as a poultry feed. Figures recently furnished by thirty-three of the leading poultry feed companies of the country show a total annual output of thirty thousand tons, and more than ten thousand tons of kafir was used in this feed.

In Growing Milo

Milo, sometimes called milo maize, has been developed rapidly in the last few years. When intro-

In Missouri.

duced into this country it had several very bad habits that rendered its general use unpopular. It stooled

too abundantly, the long "gooseneck" heads curled down and there was a rather abundant branching.

In the past four or five years, the development of milo as a grain crop has been progressing rapidly along desirable lines. The carefully selected milo of today is a great improvement over the common, unselected crop. Ordinary milo has been reduced by selection to a uniform height of from four to four and one-half feet in the Plains regions lying at an elevation of 3,000 to 4,000 feet above sea level, or at an equivalent latitude. Through selection and thicker seeding, the heads have been changed from mostly pendent to mostly erect. All heads not leaning over more than thirty degrees from the perpendicular are classed as erect, since for all practical purposes they are erect. From seventy-five to ninety per cent have been brought to this position in different strains.

Distribution of Milo

C. R. Ball, in charge of the government sorghum investigations, in speaking of the distribution of milo, said:

"Milo can be grown successfully on the lower plains of eastern Oklahoma, eastern Kansas, and southern Nebraska, where kafir varieties are now the leading grain sorghums. In this eastern section

of the plains, corn is ordinarily a profitable crop, and the acreage of milo will depend on seasonable variations. In dry years, milo should be largely grown there, but in wet years it will be replaced by corn to a considerable extent.

"It seems probable that the limits of successful production of milo can be rapidly extended northward and westward from the present area. In 1907 milo was ripened at several points in eastern Colorado at elevations of 5,500 to 6,000 feet. It was fully matured at the agricultural experiment substation at North Platte, in western Nebraska."

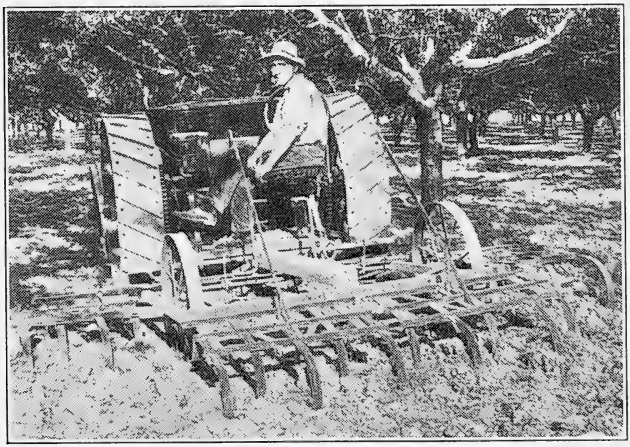
Rate of Planting Milo

For the highest yields of grain, from five to six pounds of seed to the acre is sufficient, in rows three and one-half feet apart. Where the soil and moisture conditions are favorable thicker planting can be done. Several years' tests on the experimental farm of the Office of Grain Investigations, at Amarillo, in the northern part of the Texas Panhandle, show that one plant to every six inches of row gives the highest grain yields under the average conditions obtaining there. The soil on this farm is a good clay loam, the elevation is 3,600 feet above sea level, and the average annual rainfall about twenty-two inches. Four pounds of seed to the acre produce under these

field conditions plants averaging six to eight inches apart—the desired stand. Thicker stands than this have generally been recommended for grain production, but are not desirable under Panhandle conditions.

The cultivation and the harvesting will be largely the same as for kafir.

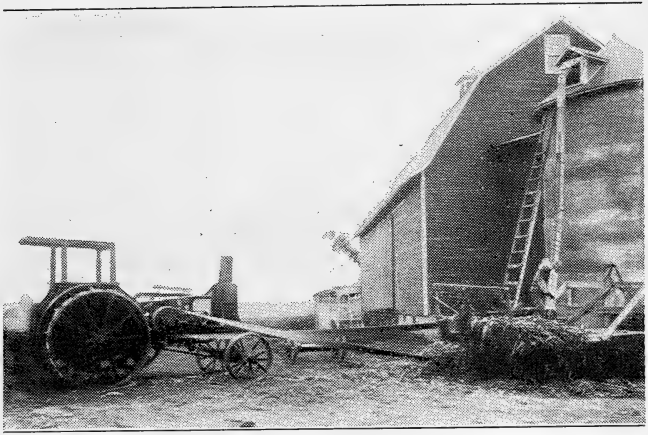
Threshing is readily done in an ordinary grain separator. To avoid cracking a considerable pro-



A "low-down" farm tractor.

portion of the seed, the concaves may be replaced with boards or part of the concave and cylinder teeth removed. The speed of the cylinder should be

reduced to about 600 revolutions a minute. Where the threshed seed is intended for feeding to stock, there is no objection if much of it has been cracked in threshing. In fact, milo is usually cracked or



Farm tractors are efficient. Power may be applied for all purposes, both at the draw-bar and the belt.

ground before being fed to stock, because otherwise much of it passes through the cattle without being digested. But where intended for use as seed grain it is, of course worthless if cracked.

The sorghums are a valuable group of plants, especially for that section of the country where rainfall is apt to be scant, and are adapted to such a wide variety of uses that a greater acreage would be profitable.

INDEX

FRUIT-GROWER

The editors of The Fruit-Grower and Farmer are practical farmers, and their principal aim in conducting the paper is to tell of the most profitable farm practices —the kinds that make farmers the most money. There is no space for impractical theory. Greater production and better selling methods are the two things most needed in American farming, for both will increase the profits. And increased profits are needed to buy the home comforts that are needed to make life really worth while.

Did your crops satisfy you last year? Were the money returns satisfactory? This paper will help you in using the best methods of farm practice, and help you in making more money. Don't you want this money during the coming year?

MORE THAN ONE HUNDRED THOUSAND

Farmers are now taking and paying for this paper. This list is now increasing rapidly, and every edition is larger than the one before. THE REASON IS THAT THE PAPER SHOWS HOW TO INCREASE THE CASH RETURNS FROM THE SOIL.

There is much lost motion between farmers and consumers. It costs too much to market the food produced in the United States, under average conditions. Some farmers and groups of farmers, however, are using methods that are eliminating the heavy selling cost of farm produce. Much space in the paper is taken up with telling of marketing methods which have been successful. These stories are obtained by members of the editorial department who travel from the Atlantic to the Pacific to get them.

ELIMINATE THE MIDDLEMEN

by adopting the methods which have successfully been used. Learn of these methods in The Fruit-Grower and Farmer.

AND FARMER

The magazine is large, the editions frequently containing one hundred pages. It is printed on a high enamel paper, and the many cuts that are used show up in fine shape. It is a monthly magazine, and the numbers are mailed on the first of the month. IT IS A PAPER YOU NEED, FOR IT WILL AID YOU IN INCREASING

HOME OF THE FRUIT-GROWER AND FARMER.

THE MONEY RETURNS FROM YOUR PLACE. Send in your subscription or a request for a sample copy today. A sample copy is free. The subscription price is one dollar for one year or two dollars for three years. Address

FRUIT-GROWER AND FARMER
ST. JOSEPH, MISSOURI

Best Books on Farming

Here is a list of the leading books on the topics that are given. In order to become a leader in the branch of farming you are handling, it will be necessary to get all the information along your line that is possible. Study this list; there are books here that will help you make more money.

GENERAL AGRICULTURE

American Cattle Doctor, by George H. Ladd, V. S., 367 pages $2.00

First Principles of Soil Fertility, by Alfred Vivian, 265 pages $1.00

There is no subject of more vital importance to the farmer than that of the best method of maintaining the fertility of the soil. In this book the author has given the gist of the subject in plain language, practically devoid of technical and scientific terms. Illustrated.

Feeding Farm Animals, by Prof. Thomas Shaw, 500 pages $2.00

This book is intended alike for the student and the farmer. His book is unquestionably the most practical work which has appeared on the subject of feeding farm animals. Illustrated.

How to Co-operate, by Herbert Myrick, 350 pages.....$1.00

This book tells how to manage a co-operative store, farm or factory, co-operative dairying, co-operative farmers' and women's exchanges, for both buying and selling. The directions given are based upon the actual experience of the successful co-operative enterprises in all parts of the United States. The character and usefulness of the book commend it to the attention of all men and women who desire to better their condition. Illustrated.

Swine in America, by F. D. Coburn, 650 pages.....$2.50

This great book on hog-raising is a guide to every farmer and a text-book to every student. Every phase of hog raising is considered from a practical standpoint. If you have anything at all to do with hogs get this book.

Meadows and Pastures, by Joseph E. Wing.....$1.50

The Book of Alfalfa, by F. D. Coburn, 336 pages..... 2.00

Clovers and How to Grow Them, by Thomas Shaw, 337 pages 1.00

The Landscape Beautiful, by F. A. Waugh, 336 pages..... 2.00

He presents a delightful study of the landscape in all its phases. All written in a most sympathetic and fascinating style.

Corn Culture, by Plumb.....$1.00

This is the best book ever prepared that treats of corn culture from a thoroughly practical application of scientific principles. Should be in the library of every corn grower.

Farm Management, by F. W. Card.....$2.00

The Science and Practice of Cheese-Making, by L. L. Van Slyke and C. A. Publow, 520 pages.....$1.75

Principles and Practice of Poultry Culture, by Robinson.... 2.50

Farm Poultry, by Watson..... 1.50

Making Money on Farm Crops, by Floyd B. Nichols, agricultural editor of The Fruit-Grower and Farmer..... 1.00

This book consists of 288 pages, and contains 79 illustrations. It is printed on a high quality enamel paper, and is bound in cloth. This book will show you how to increase your yields and eliminate lost motion in cultivating and handling crops.

Alfalfa in America, by Joseph E. Wing.....$2.00

Money in Dairying, by H. B. Gurler..... 1.00

Systematic Bookkeeping for Farmers, by Fred M. Baird.... 1.00

This book gives a simple and easily learned method of keeping farm accounts. It should be in the hands of all business farmers.

Weeds and How to Eradicate Them, by Thomas Shaw.....$0.50

Fences, Gates and Bridges..... .50

Physics of Agriculture, by F. H. King..... 1.75

SOILS

Soils, by C. W. Burkett.....$1.25

In this book, the essential facts of soil management are set forth in a pleasing and attractive manner. This book ought to be in the hands of every farmer in the United States.

Soil Fertility and Permanent Agriculture, by C. G. Hopkins $2.25
This is a book that is of great value in the solving of soil problems.

Soils, S. W. Fletcher.....$2.00

Soil, The, F. H. King..... 1.50

FARM MACHINERY

Farm Machinery and Farm Motors, by J. B. Davidson and L. W. Chase, 520 pages.....$2.00

Farm Machinery and Farm Motors is the first American book published on the subject of Farm Machinery since that written by J. J. Thomas in 1907. Modern farm machinery is indispensable in present-day farming and Farm Machinery and Farm Motors will fill a much-felt need. Profusely illustrated.

Power and the Plow, by L. W. Ellis and E. A. Rumley....$1.50

The first attempt at a complete scientific statement of the problems arising from the introduction of mechanical power to plowing. How to operate and care for tractors.

Answers on Automobiles.....$1.50

Gives clear, concise and practical information on caring, running and repairing. 512 pages with 380 drawings.

Gasoline Engines on the Farm, by Zeno W. Putman, 556 pages, 179 illustrations $2.50

A practical treatise on gasoline and kerosene engines. Tells how to run and manage engines—how to apply to all kinds of work to best advantage.

Farm Engines and How to Run Them, by J. H. Stephenson $1.00

Traction Engine, The, J. H. Maggard..... 1.00

FRUIT AND VEGETABLE GROWING

Bean Culture, by Glenn C. Sevey, B. S., 144 pages.....$0.50

Celery Culture, by W. R. Beattie, 150 pages.....$0.50

A practical guide for beginners and a standard reference of great interest to persons already engaged in celery growing. Fully illustrated.

The New Onion Culture, by T. Greiner, 140 pages.....$0.50

A new method of growing onions of largest size and yield, on less land, than can be raised by the old plan. Illustrated.

Cabbage, Cauliflower, by C. L. Allen, 126 pages.....$0.50

A practical treatise on the various types and varieties of cabbage, cauliflower, broccoli, sprouts, kale, collards and kohl-rabi.

American Fruit Culturist, by John J. Thomas, 758 pages...$2.50

Containing practical directions for the propagation and culture of all the fruits adapted to the United States. Richly illustrated by nearly 300 engravings.

Foundations of American Grape Culture, by T. V. Munson, 250 pages $2.00

Fruit Harvesting, Storing, Marketing, by F. A. Waugh, 232 pages 1.00

Small Fruit Culturist, by Andrew S. Fuller, 298 pages..... 1.00

The book covers the whole ground of propagating small fruit, their culture, varieties, packing for market, etc. It's thoroughly illustrated.

Grape Culturist, 282 pages, by S. A. Fuller.....$1.50

This is one of the very best works on the culture of the hardy grapes, with full directions for all departments of propagation, culture, etc. With 150 excellent engravings illustrating planting, training and grafting.

Tomato Culture, by Will W. Tracy, 150 pages.....$0.50

Asparagus, by F. M. Hexamer, 174 pages.....$0.50

Vegetable Gardening, by R. L. Watts, 550 pages..... 1.75

Principles of Fruit-Growing, by L. H. Bailey..... 1.50

A complete treatise on the practice of fruit-growing, comprising an inventory of fruits and a full discussion of the tillage, planting and fertilizing fruit lands and the protection of fruit plants from disease, frosts and other dangers.

The Fruit-Growers Guide-Book, by E. H. Favor, horticultural editor of The Fruit-Grower and Farmer.....$1.00

This book is the most practical, up-to-the-minute work ever written on fruit raising for the commercial orchardist, the home gardener and the student. It is an up-to-date, modern book for the man with thousands of trees, as well as for the man with a few trees in his dooryard. It contains information that can be applied every day in the work of handling a fruit plantation. It is bound in a handsome cloth binding.

The Nursery Book, by L. H. Bailey.....$1.50

A complete guide to the multiplication of plants. A standard work for nurserymen. Revised and enlarged.

The Potato, Grubb and Guilford.....$2.00

Fruit-Growing in Arid Regions, Paddock and Whipple.....$1.50

INSECTS

Economic Entomology, by J. B. Smith.....$2.50

Insects and Insecticides, by C. W. Weed..... 1.50

Insects Injurious to Fruits, by W. Saunders..... 2.00

Insects Injurious to Staple Crops, by E. D. Sanderson..... 1.50

Injurious Insects, O'Kane..... 2.00

All of the listed books will be sent postpaid on receipt of the price. And no matter whether a book is listed here or not, we can get it for you at the publisher's price. Tell us your book wants. Address

FRUIT-GROWER AND FARMER
ST. JOSEPH, MISSOURI